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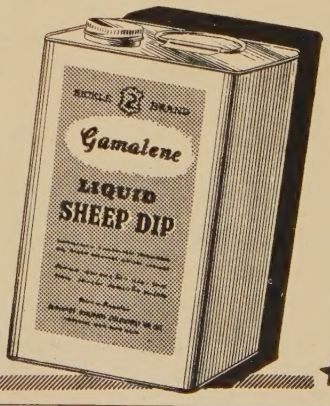

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PASTURE COMPETITION.

ALBANY AGRICULTURAL AND HORTICULTURAL SOCIETY. 1947-48.

Judges: M CULLITY, Superintendent of Dairying—C. W. TOBIN, Dairy Instructor.

FOR the second year a Pasture Competition was conducted by the Albany Agricultural and Horticultural Society.

In the first year it was arranged that two sections should be included:—

(1) Pasture on high land,

(2) Pasture on flat land, (which would remain green through the summer months), with each entry limited to one acre.

In the recent competition, however, it was decided to have the entry cover the whole pasture on the property.

Two judgings were arranged; one between 26th November and 4th December, the second—designed to assess the amount of perennial species in the pasture —on the 18th of February.

The value of these competitions is great and the Society, therefore, performed a very useful function in undertaking their organisation.

Competitors were extremely helpful in showing the pastures and describing their system of management.

Seasonal conditions for pasture in the district during the winter and spring of 1947 were better than for many years past. In some parts of the district deterioration in pastures had occurred in the two previous years, but the more favourable climatic conditions of this year appeared to be responsible for a remarkable general recovery, particularly with regard to the growth of subterranean clover. These conditions enabled farms and pastures to be presented in their prime at the first time of judging.

The second judging in mid-February, after a fairly long dry spell, presented pasture paddocks in an altogether different aspect and it was then management practices could be compared and fairly judged.

The points awarded to each entry are shown in the following table:—

Competitor.	Density and Evenness of Sward. *60	Absence Weeds and Insect Pests. 25	Botanical Composition. 40	Management. † 75	Total. 200
R. B. Wilkinson, King River	52	23	36	72	183
Farr Bros., Young's Siding	53	22	35	71	181
F. Pease, Torbay ...	53	22	36	67	178
J. F. Wilkinson, Kronkup	51	21	34	68	174
N. James, King River ...	52	21	33	66	172
L. Jordan, Napier ...	52	18	32	69	171
G. A. Smith, Redmond ...	54	22	35	60	171
A. Gale, Napier ...	54	20	32	64	170
W. Gibb, King River ...	52	21	34	61	168
H. Riggs, Napier ...	50	19	32	65	166

E. Poole, Lower Kalgan, withdrew from competition before second judging.
*According to age and soil type. †Including fencing and condition of fences and method of grazing.

R. B. Wilkinson.—Light jarrah-redgum country, including a bottle-brush flat, had been used to establish 175 acres of pasture. The area was sub-divided into 21 paddocks, well-planned and of convenient sizes. The condition of the pasture indicated good management. The species included mainly subterranean clover, with rye grasses being established, on the hill country; a fair area of kikuyu on the slopes and on the flat drooping flower, strawberry and lotus major clovers with paspalum grass, a little Yorkshire Fog and sweet vernal. Some silver grass and cape-weed present. The stocking comprised 20 milking cows and 27 head of other stock.

Fertiliser at the rate of 1 bag superphosphate per acre was applied, with an additional amount on summer land.

Farr Bros.—100 acres had been put down to pasture on jarrah-redgum country, and had been divided into 10 paddocks of varying sizes. An additional 50 acres of land on a nearby farm was used to accommodate the dry stock. The species comprised mainly dense subterranean clover with strong perennial and Wimmera rye grasses: some lotus minor, Yorkshire Fog, sweet vernal and the weaker grasses was present in the back paddocks, and the growth included dock and other weeds. An area of 5 acres had been put down to kikuyu grass combined with subterranean clover. On an area of new country, there was a good first year growth of subterranean clover which had been sown-on-the-burn.

The stocking comprised 33 cows with 27 head of other stock.

Fertilising had been carried out at the rate of 1 bag of superphosphate per acre, with heavier dressings on the hay paddocks.

F. Pease.—On good type jarrah-redgum country 70 acres of pasture had been established and sub-divided into 17 paddocks of varying sizes. Growth of subterranean clover and Wimmera rye grass was dense on the hay paddocks, with good growth of varying mixture and density elsewhere. Some paddocks contained drooping flowered clover, oats, a little lotus minor and kikuyu grass. The weeds seen comprised a little rush, sorrel and a few docks.

The stocking comprised of 24 cows plus 16 head of other stock, and was high. The fodder conservation programme and the growing of a fair area of maize planted in stages, is commended.

Fertilising was at the rate of 1 bag of superphosphate per acre.

J. F. Wilkinson.—40 acres of pasture had been established on low land of good loamy soil, subdivided into 8 paddocks. The species were mainly subterranean clover with Wimmera and Perennial rye grasses of fair density and uniformity, and some kikuyu and lotus major. A little silver grass and rush growth were to be seen.

This farmer's activities combined potato growing and sheep grazing and the stocking of the holding comprised 175 sheep.

Fertiliser used on this property was potato manure at the rate of 90-lbs per acre.

N. James.—This is a comparatively new farm with 60 acres of pasture established on light, stunted jarrah-sheoak country. The area had been subdivided into 7 paddocks. Clover and rye grass showed a good early growth on poor sandy soil, in response to the use of copper.

Stocking comprised 17 cows plus 13 other cattle.

L. Jordan.—The pasture area was 104 acres on jarrah-redgum country and was subdivided into 10 paddocks. This is a well farmed holding and is in fair order.

Stocking comprised 25 cows plus 15 other cattle.

G. A. Smith.—110 acres of pasture had been established on fairly heavy jarrah-redgum country and divided into 13 paddocks on fairly heavy jarrah-redgum country. There was a good showing in the spring but the paddocks were fairly bare on the second judging. A nice area of kikuyu has been established.

Stocking comprised 23 cows and 42 other cattle.

A. Gale.—The pasture area of 30 acres on jarrah-redgum country had been divided into 6 paddocks. There was a good showing of subterranean clover in the spring.

Stocking comprised 8 cows plus 12 other cattle.

W. Gibb.—40 acres of pasture sown on very light sandy soil and divided into 9 paddocks.

Stocking comprised 4 cows plus 4 other cattle and 50 sheep.

H. Riggs.—60 acres of pasture established on jarrah-redgum country, showed general deterioration, possibly due to insufficient superphosphate dressings in previous years.

Stocking comprised 23 head of dry cattle.

MILL OFFAL FOR RABBIT POISONING.

A. S. WILD, Chief Inspector, Vermin Branch.

THE most common and perhaps the most expedient method of rabbit destruction is that of distributing baits prepared from bran and pollard and poisoned with phosphorus mixture. The comparative ease of preparation and also distribution through poison carts, the area of land which can be treated at a convenient time of the year, and the fact that paddocks may be used for stock a reasonable time after treatment, all render this method especially attractive to those responsible for the destruction of rabbits. The present shortage of both bran and pollard is therefore unfortunate now that rabbits are showing decided increases in numbers, and, where these materials are unprocurable, it is necessary to use substitutes. These substitutes are marketed as branato and polato, the former being the coarse material from crushed wheat and the latter, the fine material. The cost of these is approximately 10d. per bushel above that of bran and pollard.

The use of these unfamiliar substances would present a difficulty to those accustomed to the mixing of bran and pollard. Generally the approximate proportion of three or four of pollard to one of bran makes a bait, which is easy to distribute through most types of poison carts, and also has a degree of friability necessary for its disintegration about a week or 10 days after distribution. However, rough tests by the Vermin Branch of the Department of Agriculture have indicated that proportion of branato to polato in mixtures needs to vary much more widely than that of bran and pollard. When the proportion of polato to branato exceeded that of equal portions a very sticky mixture was produced, and, under field conditions, baits tended to seal up. This condition would tend to maintain unconsumed baits in a condition dangerous to stock. It is evident that the greater proportion of a mixture must consist of branato rather than polato, and, for the smaller types of distributors, two of branato could probably be used to one of polato. For the larger type of poison cart probably three of branato to two of polato would be most suitable. Such a mixture should be of the right consistency for distribution and at the same time be sufficiently friable for disintegration within a reasonable period of time, so that, subsequently, stock could be placed in the paddock without danger of poisoning from unconsumed baits.

MEADOW HAY COMPETITION, 1947-1948.

ALBANY AGRICULTURAL & HORTICULTURAL SOCIETY.

Judges: M. CULLITY, Superintendent of Dairying & C. W. TOBIN, Dairy Instructor.

THE Australian Dairy Produce Board, Pasture Improvement Committee, West Australia, has sponsored and donated prizes for numerous pasture and meadow hay competitions in the dairying districts in recent years. It has been particularly interested in the south coastal districts and arranged to co-operate with the Albany Agricultural and Horticultural Society in conducting this competition.

The basis of adjudication was laid down in the following scale of points:—

	Points.
Mixture—Botanical Composition	20
Type and Palatability	30
Time of cutting	25
Aroma	10
Amount conserved per cow	15
Total	100

Minimum quantity: 10 tons.

Judging to be conducted after stacking or baling, (early, February).

This scale was designed to enable each competitor to assess from the results the good and bad features of his entry, and also to encourage each to study the characteristics of good hay and the value of the conservation of sufficient quantities. To assist in achieving this result, the following explanation of the method of judging is given:—

1.—*Botanical Composition.*

Maximum points would have been given to a mixture of clovers and grasses of good quality. For example—a mixture of 60% subterranean clover and 40% perennial rye-grass, Cocksfoot or Phalaris tuberosa, would get full points.

The presence of weeds, relatively innutritious grasses such as spear grass, would result in a reduction of points. Too little grass of good quality or too little clover, would cause a similar reduction in rating.

2.—*Type and palatability.*

It is, of course, impossible to assess palatability directly but the following characteristics are taken as indicating attractiveness:—

(a) *Colour.*—The greatest number of points are given to those samples with the greenest colour, as the retention of natural greenness is taken as an indication of the hay having been protected in curing and therefore having retained the natural high nutrient content in respect of protein, and vitamin, as well as palatability.

(b) *Leaf.*—The retention of the leaves is proof also of care in making, but more important, the leaves are the most valuable section of the plant, measured as sources of protein and vitamins.

(c) *Condition.*—The hay should be dry enough to avoid heating in the stack, but sufficient moisture to allow handling without the loss of leaf is necessary.

3.—*Time of cutting.*

In deciding the stage at which hay should be cut, the farmer has to achieve a nice balance between food quality and yield. There is no question that if hay were cut earlier than the conventional stage the actual value in feeding, particularly as a source of protein, would be greater. This, however, could be achieved only at the sacrifice of considerable weight. In cereals, hay is cut after flowering, but before the grain is hardening. Variations in the stage of cutting occur in oats and wheat. The former is cut later in order to avoid bitterness, which occurs in some varieties.

With subterranean clover, it is usual to cut when the top flowers are forming. At this stage most of the annual grasses will be in seed, while seed is forming in perennial rye-grass.

In this section, therefore, an examination is made to determine as closely as possible, whether the crop has been cut at the right stage. More points are lost for late than for early cutting. The latter rarely occurs.

4.—*Aroma.*

This is self-explanatory. The aroma must be clean, sweet and bright, suggesting extreme palatability. The presence of mustiness is a defect.

5.—*Amount per cow.*

An amount of 2½ tons of hay, or its equivalent as silage or green crop, per cow was adopted as the basis for maximum points. This quantity is that needed to fully feed a herd from the end of hay-cutting till there is ample pasture feed at the end of the following July.

Where silage or green crops were available the equivalent as hay was calculated and added to the estimate of the quantity of hay available.

The points allotted to the entries are shown in the following table:—

Competitor.	Botanical Mixture. 20	Type and Palatability. 30	Time of Cutting. 25	Aroma. 10	Amount per Cow. 15	Total. 100
R. B. Wilkinson, King River	18	24	22	8	9	81
F. Pease, Torbay ...	18	22	24	7	9	80
Farr Bros., Young's Siding	17	21	23	8	5	74
W. Gibb, King River ...	17	19	18	7	12	73
H. Riggs, Napier ...	14	17	18	5	15	69
L. Jordan, Napier ...	16	18	18	6	9	67
N. James, King River ...	15	17	20	5	4	61

Comments on each entry are as follow:—

R. B. Wilkinson.—The hay was of fairly good colour and aroma. There was ample clover mixed with some rye-grass, sweet vernal and paspalum.

The quantity conserved was not sufficient for adequately feeding the herd through a dry summer, but the presence of green pasture paddocks on this property is a safeguard.

F. Pease.—More than one stack was inspected. One, however, was a carry-over from the previous year and had suffered through weathering, otherwise this entry would have scored higher points. The general character and condition of the new stacks were good.

The quantity conserved was supplemented by a stack of silage and several acres of green crop.

Farr Bros.—An excellent mixture of subterranean clover and rye-grass had been cured. Colour was good, but the aroma was sweetish and musty. The material had been cut a little late and had suffered slightly from rain damage.

The quantity conserved was lower in proportion than for the two leading entrants.

W. Gibb.—The hay was variable: Some was pure-clover with other sections almost solely grass. The species included, however, were mostly of attractive types, but unfortunately cut late and allowed to become brittle. Leaf loss on a portion was high.

There was a greater reserve of hay in proportion to the stock to be fed, on this property than on those of the leading competitors.

H. Riggs.—This was the only competitor with baled hay. The mixture, however, was not quite as attractive as the other competitors inasmuch as a greater proportion of poor grass was included. Consequently points were lost for type and palatability, as well as for mixture.

This entrant, however, had a greater supply of stored fodder in proportion to his stock than the others. The value of baling was well demonstrated.

L. Jordan.—Both silage and hay were stored. The hay was made from oats, subterranean clover, rye-grass plus a proportion of spear and soft brome grasses. The hay was a little too dry and lost points on that account. Allowance was made for quantity because of the stock of approximately 30 tons of silage. The value of this succulent feed was apparent in its palatability for the cows and in their sleek appearance.

N. James.—A good variety of species was included in this hay, but too little clover was present to enable high points to be allotted. Oats, subterranean clover, soft brome grass, Lotus sp. and other species were included. The aroma was fair only, while the hay generally was dry and dusty. It appeared that through force of circumstances the gathering and stacking of the crop had been unduly delayed.

GRADING STANDARDS FOR EXPORT LAMBS

F. L. SHIER, Export Lamb Adviser.

IN pre-war days fat lambs were exported from Australia under four quality grades, namely "Downs," Firsts or Blues, Seconds or Reds, and Thirds or Whites, with a number of sub-grades or weight ranges. In the war period and under the Imperial Government Purchase plan with the Commonwealth Government the down grade was eliminated, owing to the small numbers involved. Shipping space had to be conserved and the overall work of transportation and distribution reduced to a minimum. Down grade lambs which normally sold at a premium of about ½d. lb. above the ordinary first grade were not graded out separately but were bulked together with the ordinary first grade.

Fullness and depth of meat (muscle) over the carcase with the correct covering of fat including selvage fat (outside), generally referred to as "finish", determines whether a lamb is graded first grade. Shape and conformation are not taken into account to the same extent as required for the down grade. To qualify for the down grade, lambs, in addition to being first grade, must be of down conformation; that is the carcases short and nuggety and exhibiting the conformation and characteristics of the down breeds. Such carcases give the high quality and priced thick short joints.

Farmers who were breeding the down type lamb felt that they were being penalised by the omission of the grade and were not receiving full value for their high quality lambs. This was freely admitted by those in control but under the circumstances then prevailing the elimination of the down grade was the only logical thing to do. However, once hostilities ceased and transportation and distribution difficulties eased, everyone associated with the industry agreed that this grade should be reintroduced. It is quite true that the omission of this grade penalised the producer of the top grade lamb of the type recommended for and desired by the London market. In time this policy could only react unfavourably on general quality and type of lamb produced in Australia for export.

In consequence therefore the down grade was reintroduced into the export lamb schedules in 1946. However gradings of lambs during 1946 and 1947 at the export works throughout Australia indicated that grading standards were not uniform. In some instances the number of "downs" being graded out of good, well bred, lines of lambs was so small as to indicate that the standard adopted by some graders was far too high and impossible to reach with any reasonable numbers by even the best breeders. Most producers are familiar with the ideal lamb, which wins at leading Agricultural shows, but it is necessary to be realistic. It would be absurd to make this ideal show carcase the standard.

The standard of the down grade should be such that reasonable numbers can be exported so that the grade and label can become widely known to the trade and housewife in England. Further, so as to act as an incentive to producers this down grade should be possible to attain with a reasonable percentage of the first grade lambs by those farmers who are adopting good recommended methods of breeding and feeding. Where the percentage of "downs" from a consignment which grades over 90 per cent. first grade, bred from crossbred ewes and Southdown sires, is only one or two per cent. then there is little inducement to continue along these lines, when other breeds may give practically the same grading but heavier weights in the same time.

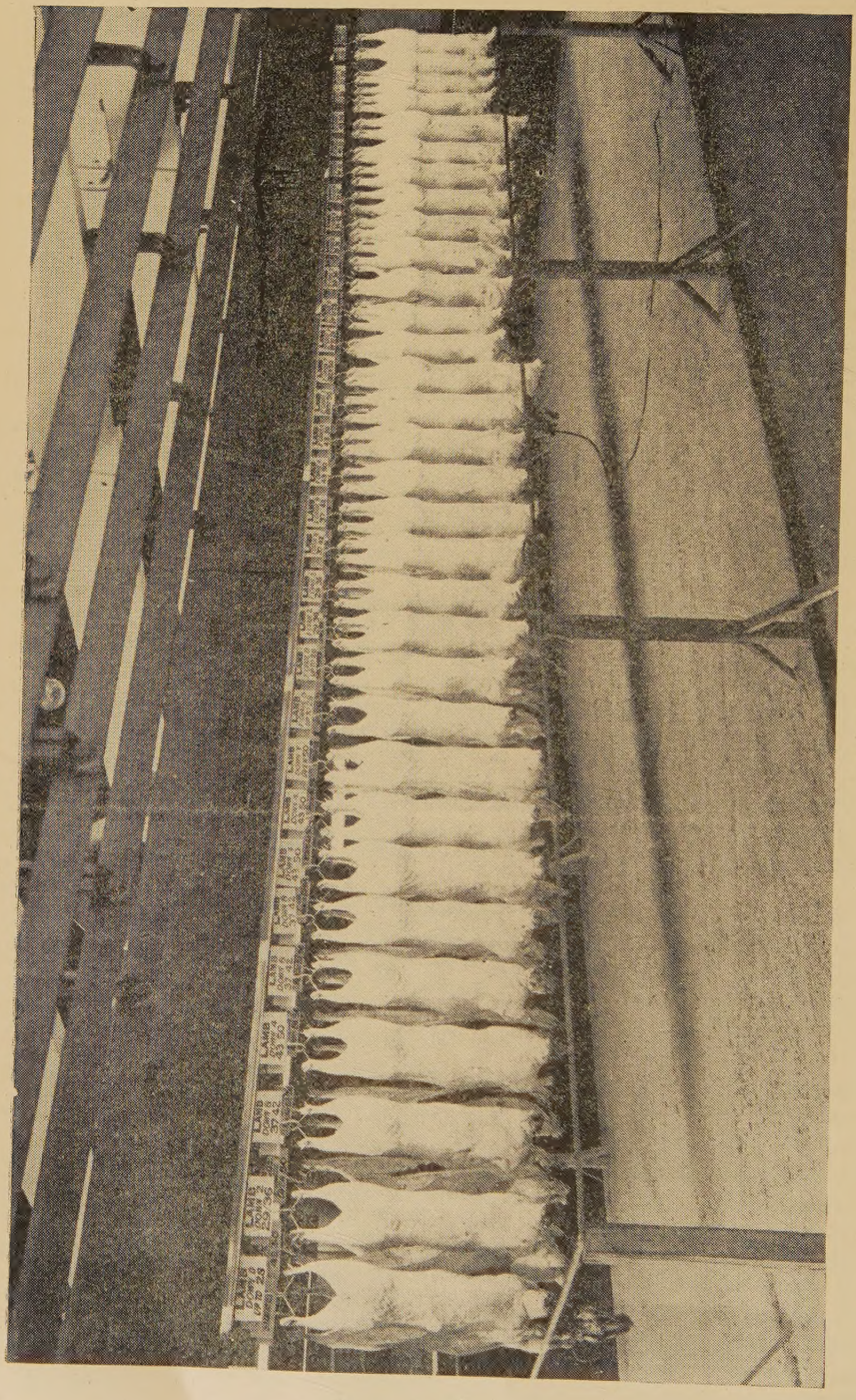


Illustration 1.

A general view of the display of lamb carcases. The down grades are on the left followed by the ordinary firsts, then seconds and finally thirds at the far right. Mutton carcases are on the line behind the lamb carcases.

Quite naturally these matters have therefore been subject to comment by all those interested in maintaining Australia's good name on the British market, including many in this State, who considered that good producers were being penalised and further that permanent harm would be done to the industry if the position was not rectified in a realistic manner.

The Australian Meat Board took the matter up last October with officers of the Commonwealth Department of Commerce and Agriculture. The latter body actually controls grading standards at the export works throughout Australia. After due consideration and investigation it was considered that the standards for both lamb and mutton in operation in Victoria (at the end of 1947) were reasonable and in the case of the down grade could be reached by producers working along sound and recommended lines.

These two bodies working in conjunction made arrangements for a conference of interested persons in Melbourne on February 16th, 1948, at which the whole question of uniform lamb and mutton grades could be discussed. A display was staged of a full range of carcases of quality grades and weight ranges then in operation in Victoria. Officers of the Department of Commerce and Agriculture demonstrated the points, qualities, and defects of the various carcases and the reasons for their being placed in the particular grades.

After a very complete discussion it was unanimously decided by the meeting, firstly that the Victorian standards as displayed should be adopted throughout Australia, and secondly that the Department of Commerce should appoint a number of standardising graders to keep grading standards uniform at all export works.

The Australian Meat Board is to be congratulated in taking the initiative in this matter, and the Chairman, Mr. J. L. Shute, for the manner in which he handled the meeting which finally came to a unanimous decision on a very contentious subject.

With the introduction of the grading standards agreed to at this Conference, West Australian producers of the down type lamb can reasonably expect an improved percentage of "Down" grade from their consignments this year.

In the accompanying illustrations, by courtesy of the Australian Meat Board, readers will obtain an appreciation of the completeness of the display and some idea of work and effort put in by officers of the Department of Commerce and Agriculture in its preparation.

It should be borne in mind that in any grade there is always a range. Some carcases are at the top of the grade and others just "scrape" in at the bottom. This display was built up from carcases available at the export works concerned towards the end of the Victorian season, and in consequence the ideal carcase for any grade or weight range could not be obtained in all instances. The illustrations do not show the range in any particular grade but do illustrate the major differences between the various grades.

As a matter of interest to producers a schedule is included hereunder giving the several quality grades and weight ranges for export lambs.

Quality Grades.	Weight Ranges lbs.				
	D's.	2's.	8's.	4's.	T's.
Downs	20–28	29–36	37–42	43–50	...
Firsts (Blue) ...	20–28	29–36	37–42	43–50	51–56
Seconds (Red) ...	20–28	29–36	37–42	43–50	...
Thirds (White) ...	L's 20–28		O's 29–50		...

Illustration 2—Down Carcases.

Down carcases of the three main weight ranges (2's 8's and 4's.) Note the short "down" conformation, short well filled legs, well filled loins and shoulders, short neck and good covering of selvage fat.

Illustration 3—Ordinary First Grade Carcases.

Compare with Illustration 2. Note the good loins and shoulders, selvage covering and general "finish" but the longer carcase, legs and neck. These carcases would not cut into similar chubby joints as would the "downs."

Illustration 4—Second Grade Carcases.

Compare with illustration 3. These carcases are not as well finished as the "firsts," showing poorer loins and legs and lighter fat covering over legs, loins and shoulders. Compare the length of leg in these carcases against those in illustrations 3 and 2.

Illustration 5—Third Grade Carcases.

Note the excessive leg length, the obvious high proportion of bone to meat, poor depth (small eye) of meat on the loins and light covering of selvage fat. The carcases indicate that the lambs suffered from under nutrition. The skeleton has continued to grow and develop but the feed available has not been sufficient for the lambs to lay down flesh and fat at the same time, resulting in poorly fleshed and "unfinished" carcases.

Illustration 6—A First, Second and Third Grade Carcase of the "D" Weight Range (20-28 lbs.).

Whilst three lambs are of a similar weight note the gradually increasing length of the carcase and length of leg; the decreasing depth of meat, fullness of the loin and covering of selvage fat; and the narrowing across the shoulder. The proportion of bone to meat gradually increases over the three carcases and is obviously very high in the 3rd grade.

LARYNGO-TRACHEITIS.

C. R. TOOP, Acting Chief Veterinary Officer,
Department of Agriculture.

INFECTIOUS Laryngo-tracheitis, one of the respiratory group of diseases of fowls, was diagnosed for the first time in Western Australia a few months ago. A survey has since shown that it is already widely distributed and occurs in various parts of the State.

The available evidence indicates that this is not a new disease in Western Australia but that it has existed in the State for a number of years and the fact that its identity has now been definitely established need not therefore occasion undue alarm.

It has been the history in all countries where laryngo-tracheitis occurs that the disease has become endemic before it has been diagnosed and Western Australia has proved no exception in this regard.

The infective agent is a virus which attacks the respiratory tract of the fowl in which it sets up inflammatory changes. The infection is believed to be spread by inhalation. The symptoms of the disease are extremely variable ranging from an acute type in which there is evidence of respiratory distress and gasping together with coughing and the expulsion of mucus and blood, to a chronic form characterised by the formation of cheesy deposits in the eyes, nasal passages, palate and larynx. Sometimes the disease occurs in so mild a form as to escape recognition.

The mortality resulting from the disease is also very variable. When it occurs in a mild form the losses may be negligible, but in severe outbreaks they may exceed 50 per cent. Mortalities of 10-15 per cent, are however more usual. To this must be added the losses resulting from depressed egg production.

Birds which have recovered from an attack of laryngo-tracheitis develop an immunity against the disease and do not again become affected. These apparently healthy recovered birds, however, may continue to harbour the virus in their respiratory tracts remaining carriers of infection which they spread to susceptible birds with which they come in contact. Thus, when the disease first makes its appearance in a hitherto clean flock, the outbreak can almost invariably be traced to the introduction of carriers from an affected property. Moreover, it is these carriers which perpetuate the disease in a flock. They spread the infection to each succeeding batch of pullets with which they come in contact and are responsible for the recurrent annual outbreaks which take place on affected properties.

When a flock is free of laryngo-tracheitis it can usually be maintained in that condition provided new introductions are confined to day-old chicks from which the risk of infection is negligible. The introduction of all other fowls including started chicks, which may be carriers of infection, must however be avoided. Once the disease has become established on a property, vaccination provides the only practical means of control.

CAUSE.

The disease is caused by a filterable virus which enters the body by way of the respiratory tract where it becomes established and remains. The infection is believed to be spread by the inhalation of fine particles of mucus containing the

virus which are expelled by diseased birds when coughing. The virus is extremely fragile and does not survive for more than a few hours apart from the fowl.

Factors such as faulty management and feeding, over-crowding, green feed (Vitamin A) deficiency and heavy worm infestation which lower the resistance of the birds and increase their susceptibility to infection predispose to the disease and, under such adverse conditions, heavy mortality may occur.

Fowls of all ages may become affected by the disease but pheasants are the only other species known to be susceptible.

White Leghorns suffering from acute Laryngo Tracheitis.

SYMPTOMS.

The symptoms exhibited by affected birds vary according to the severity of the attack. In the acute form of the disease there are symptoms of gasping and difficult respiration; the neck is extended during inspiration, the mouth is opened widely and gurgling or rattling sounds due to the presence of a copious secretion of mucus in the trachea (windpipe) may be heard. In some cases a frothy mucous discharge may be present in the eyes and nostrils. Affected birds cough frequently and shake their heads vigorously and this may be accompanied by the expulsion of mucus, which sometimes contains blood, and is usually followed by swallowing movements. The beak is wiped frequently on the feathers of the back which, in consequence, becomes dirty and matted in appearance. Birds affected by the acute form of the disease may die within 24 hours of the onset of symptoms.

The chronic form of the disease is characterised by the formation of yellow caseous (cheesy) deposits in the eyes, infra-orbital sinuses, palate, nasal passages and larynx. This may result in "bunging up" of the eyes and blindness or in the development of large swellings beneath the eyes due to the distension of the sinuses with this cheesy material. When the larynx becomes involved, respiration becomes difficult and may be accompanied by wheezing and whistling. In many cases the larynx becomes completely blocked by a plug of cheesy material and death results from suffocation. Affected birds lose condition rapidly becoming ruffled and dejected in appearance and there is a foul odour from the mouth and nostrils.

POST-MORTEM APPEARANCES.

In carrying out a post mortem examination, the larynx and trachea (windpipe) should be opened with scissors, care being taken to prevent the entrance of blood into its cavity from the surrounding tissues.

In the acute form of the disease the larynx and trachea will be found to contain an abundant mucous secretion and the lining membranes may be swollen and acutely inflamed. In some cases there is haemorrhage into the trachea when free blood or blood stained mucus will be found in its cavity. The mucus secretion, at first fluid, later solidifies being replaced by a yellowish cheesy exudate which sometimes takes the form of a tube-like cast lining the whole or portion of the trachea.

In the chronic form of the disease involvement of the trachea is unusual, the lesions being confined to the eyes and associated structures, palate, nasal passages and larynx any or all of which may be found to contain a yellow caseous (cheesy) exudate. The formation of these cheesy deposits is always preceded by the presence of a fluid mucous discharge.

The changes which occur in laryngo-tracheitis are confined to the respiratory tract; no abnormalities being observed in other tissues or organs.

DIAGNOSIS.

Since laryngo-tracheitis, particularly in the less acute and chronic forms, may be readily confused with certain other of the respiratory group of diseases affecting fowls, diagnosis frequently presents a difficult problem and it is only when the disease occurs in the peracute form accompanied by high mortality, symptoms of severe respiratory distress and haemorrhage into the trachea that a positive diagnosis can be justified on clinical grounds. The presence of blood or bloody mucus in the trachea is diagnostic of laryngo-tracheitis and does not occur in any of the other respiratory diseases of the fowl.

In the absence of haemorrhage, however, the disease may be confused with Coryza and in order to differentiate the two conditions and establish a definite diagnosis it is necessary to resort to laboratory methods involving transmission experiments, immunity tests and the bacteriological examination of discharges from affected birds.

It should, however, be recognised that whereas recovery from an attack of laryngo-tracheitis confers a life-long immunity no such immunity results from an attack of Coryza and recurrent outbreaks of this disease may continue to occur amongst birds of all ages on the property. In contrast in a flock affected by laryngo-tracheitis the annual outbreaks which occur are confined to the young stock on the property; the older birds which have become immune through previous exposure remaining healthy.

Other diseases occurring in Western Australia which might possibly be confused with laryngo-tracheitis, include fowl pox and Vitamin A (green feed) deficiency. Mortality from fowl pox, however, is usually very low and in addition to the cheesy deposits that may develop in the eyes and mouth, wart-like eruptions are usually present on the comb and wattles.

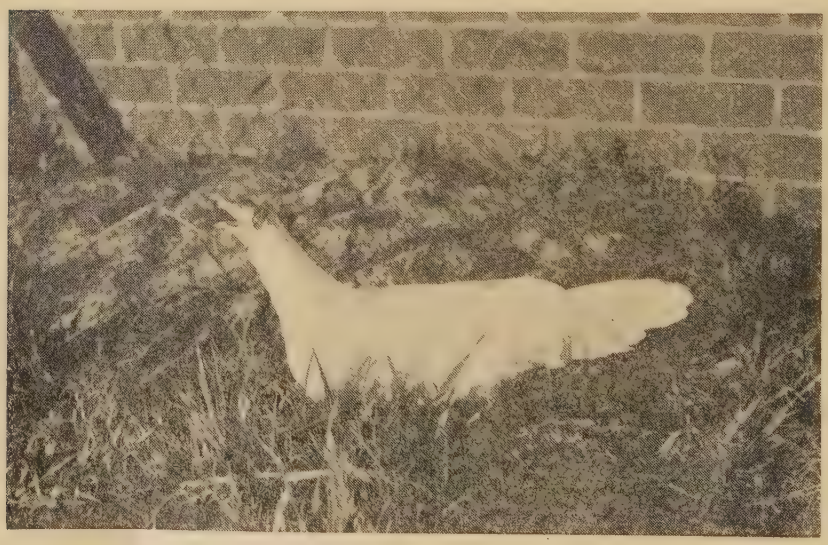
In the case of green feed deficiency besides the lesions in the eyes and mouth, pustules will be observed in the gullet often extending down to the crop. Moreover, a rapid recovery will occur when the Vitamin A deficiency is corrected by feeding adequate amounts of good quality green stuff or by the addition of a Vitamin A rich supplement such as shark liver oil or some similar preparation to the ration.

Poultry farmers who suspect the existence of laryngo-tracheitis in their flocks are requested to forward specimen birds to this Department for examination. Recovered birds which have survived an outbreak of the disease are best for this purpose, since they contain neutralising anti-bodies in their blood which may be subjected to immunity tests enabling a positive diagnosis to be made. In cases where an outbreak of disease is actually in progress, arrangements will be made for an investigation to be conducted on the property.

IMMUNITY—CARRIERS.

Recovery from laryngo-tracheitis results in the development of a life-long immunity so that birds that have survived an outbreak of the disease do not again become affected. Recovered birds may, however, continue to harbour the virus in some part of their respiratory tract, remaining carriers of infection and spreading the disease to susceptible birds with which they come in contact. It is these apparently healthy carriers which are responsible for the recurrent annual outbreaks, which take place on affected properties, since they transmit the disease to the susceptible young stock when contact occurs after they have been transferred from the rearing pens. Thus, when laryngo-tracheitis first makes its appearance in a flock, birds of all ages become affected, but in subsequent outbreaks the disease is confined to the young stock on the property, the older birds, although spreading the disease, remaining healthy.

Similarly, when an outbreak occurs in a hitherto clean flock, this can almost invariably be traced to the introduction of carriers from an outside source.



White Leghorn showing signs of acute Laryngo Tracteitis.

HOW TO PREVENT THE INTRODUCTION OF THE DISEASE.

A flock which is free of laryngo-tracheitis can usually be maintained in that condition indefinitely provided carriers are not introduced on to the property. This may be assured by restricting new introductions to day-old chicks from which the risk of infection is negligible. The introduction of any other fowls on to the property must at all costs be avoided, and this will apply not only in the case of adult birds intended for breeding purposes or egg production, but also to started chicks.

Apart from the introduction of carriers, the disease is only likely to be introduced into a clean flock through close proximity to an affected neighbouring property. Since the virus does not survive for more than a few hours, apart from the fowl the introduction of infection through the agency of crates or coops that have been in contact with diseased birds appears to be remote.

The disease is not transmitted through the egg, so that eggs intended for incubation may be purchased with perfect safety.

CONTROL OF THE DISEASE—VACCINATION.

On properties where the disease is known to exist, vaccination provides the only practical means of control. This consists in lightly scarifying the cloaca or vent with an applicator designed for the purpose, and, at the same time, applying a small amount of the laryngo-tracheitis virus to the scarified area.

Successful vaccination results in the development of a local inflammatory reaction or "take" which stimulates the formation of antibodies in the blood and tissues of the treated bird, thus enabling it to resist the disease. This immunity develops after an interval of 7-10 days and will protect the bird from infection during the remainder of its life.

Pullets and other young stock should be vaccinated after reaching the age of 10-12 weeks. Following vaccination a small proportion of the birds may actually develop the disease and thereafter become carriers. The indiscriminate vaccination of clean flocks would consequently result in the further dissemination of the disease and cannot be permitted.

Vaccination must for the present be confined to properties or localities in which the disease is actually known to occur. Further particulars regarding vaccination may be obtained upon application to this Department.

When the disease occurs in a small flock, upon which the owner is not dependent for a livelihood, its eradication by the slaughter of all fowls on the property followed by restocking with day-old chicks should, in most cases, provide the best means of control. The adult birds could be disposed of at a favourable opportunity and restocking with day-old chicks would ensure against the reintroduction of infection.

QUARANTINE AREA.

In order to prevent the further spread of the disease to country districts, a quarantine area embracing the metropolitan area and including the Municipalities of Perth, Fremantle, East Fremantle, North Fremantle, Cottesloe, Claremont, Subiaco, Guildford and Midland Junction, and the Road Districts of Fremantle, Buckland Hill, Peppermint Grove, Nedlands, Perth, Bayswater, Belmont Park, Bassendean, Canning, Gosnells, South Perth, Melville, Armadale-Kelmscott, Darling Range, Mundaring and Swan has been declared.

No fowls other than day-old chicks and started chicks not exceeding the age of eight weeks produced on hatcheries upon which no adult fowls are kept, will be permitted to be removed from this quarantine area to the country districts.

THE LUCERNE FLEA.

(*SMINTHURUS VIRIDIS* L.)

E.M.N.

By

C. F. H. JENKINS, Government Entomologist.

P. N. FORTE, Assistant Entomologist.

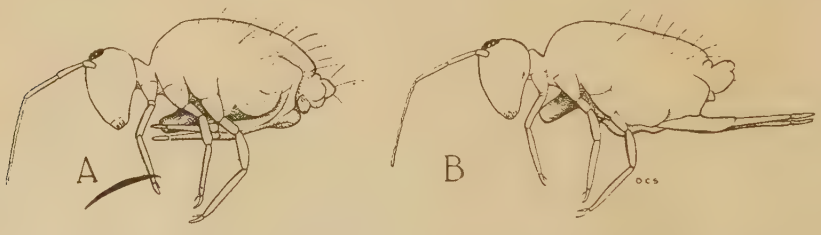
THE lucerne flea or clover springtail is best known in this State as a pest of clover pastures, but various plants, including many types of vegetables, are also liable to attack.

The insect is of European origin, being widely distributed over that continent. It occurs also on the north coast of Africa, in the Argentine, and in all the Australian States with the exception of Queensland.

The date of its introduction into Australia is not known, but it was noted in South Australia as early as 1884. It was not until 1910 that the pest was observed in Western Australia, and it is believed that baled fodder imported from South Australia was the medium of introduction.

GENERAL DESCRIPTION.

The terms flea and springtail imply that the insect is a good jumper, and this is very true, but the creature is not by any means closely related to the true flea. It does not jump by means of well developed legs, as does the flea, but with the aid of a special organ known as the spring. Reference to the accompanying illustration will show just how this mechanism works.



Sketches showing the mechanism of the spring. (A) Spring folded under body in the normal position. (B) Spring extended after jumping. The structure projecting from between the middle pair of legs is the base of the ventral tube (adhesive organ). Only the appendages on the near side are shown.

(After Swan.)

The insect is a dumpy-looking creature, wingless and about 1/10th of an inch in length. The colour pattern varies greatly but green or greenish yellow usually predominates. The mouth parts are of the biting type and the plant material is actually chewed and swallowed.

LIFE HISTORY.

The eggs are laid in batches in moist situations either on the soil surface or beneath decaying leaves and debris. After being laid the eggs are covered by the female with a fluid consisting largely of excreted soil, and on drying, this coating renders the eggs very difficult to detect.

In captivity the female has been noted to lay about 60 eggs to a batch and two batches appear to be the average. Under favourable conditions the eggs hatch after three or four days and a "nymph" emerges, resembling its parents in general appearance, but much smaller. The time required for the nymph to develop fully will vary greatly with weather conditions, but is about a month under normal circumstances. As the active period of this pest is approximately from May to October, it is evident that a number of generations can develop during the season.

When warm, dry conditions arise the eggs fail to develop. They successfully withstand the heat and desiccation of the summer until the next autumn rains again bring about conditions favourable for hatching to take place.

HABITS.

The lucerne flea, like the red-legged earth mite, is very dependent upon moisture and quickly succumbs should hot, dry conditions prevail for any length of time. It is seldom a serious pest in sandy localities, but thrives on heavy and slightly acid soils. The reason for this is probably associated with the insect's habit of eating quantities of soil during its life.

The injury caused by the lucerne flea is quite characteristic; small irregular portions of the leaf may be eaten right away, leaving a ragged hole, or the lower surface of the leaf may be left intact as a whitish film.

Dorsal view of Lucerne flea.
(After Swan.)

Lucerne flea injury is sometimes confused with that caused by the red-legged earth mite, for both pests favour much the same environment and have a preference for seedlings and low-growing, wide-leaved plants, but a careful inspection will soon reveal characteristic differences in the injury caused by each.

The mite is a sap sucker, and so does not actually remove any of the solid plant tissue. No jagged holes will be seen in leaves attacked by the mite and leaves bleached by the lucerne flea will be almost transparent when held up to the light. The mite-injured leaves, although bleached, still remain opaque.

Clover damaged by lucerne flea.
(After Dumbleton.)

Although clovers and lucerne are the favourite food plants of the lucerne flea, capeweed is also a very important host plant and often shows severe injury. Vegetables, such as peas, beans and potatoes, grown in close proximity to weedy land supporting a growth of capeweed may be seriously affected.

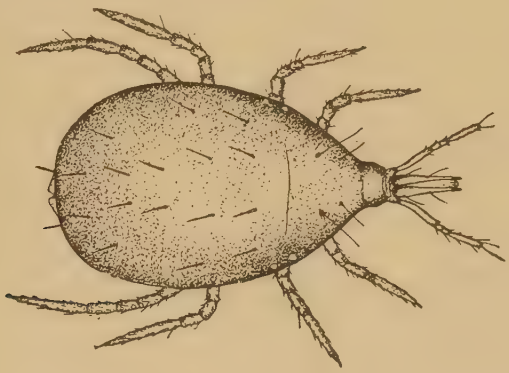
CONTROL.

Cultural Methods.—The advantage of clean cultivation in the establishment of clover or lucerne will be obvious, bearing in mind the wide host range of the pest, and its liking for capeweed. While it is not always practicable to plant on clean fallow, where this can be done, serious insect infestation can only take place from dirty fence lines and headlands, and a firm stand may be secured before a high insect population can be reached. In the case of lucerne early spring planting is sometimes possible. The "flea" population gradually diminishes with the advance of summer whereas the growing conditions for the lucerne (if moisture is available) become increasingly favourable. By the following winter the plants should be quite well established and much better able to withstand both lucerne flea and red-legged earth mite attack than freshly sprouted seedlings.

Biological Control.—A species of predatory mite commonly known as the Bdellid mite (*Biscirus lapidarius*)was discovered in this State in 1932 and its main food was found to be the lucerne flea. In permanent pasture lands the mite has shown its ability to exercise a controlling influence on the flea, but it has by no means solved the lucerne flea problem. For many years the mite was distributed by the Department of Agriculture in order to ensure its introduction into the principal clover growing districts. The creature now has a wide range in the lower South-West and wholesale distribution has been discontinued. The

natural spread of the mite is rather slow and some farmers believe in spreading the predators over their paddocks whenever they find a particularly active colony at work. The mite is a little over 1/16th inch in length, reddish in colour, has a long "snout," eight legs and two prominent "feelers."

It has a habit of hiding, particularly during warm spells, under pieces of bark, slats of wood and other suitable cover. Such material and the adhering mites can be collected in a bucket or other receptacle and transferred to areas where the flea is particularly troublesome.



The lucerne flea predator.
(Biscirus lapidarius.)

Chemical Control.—Poison sprays such as arsenate of lead can be effectively used against the pest but under most conditions the use of such poisons are impracticable on account of the risk to stock. A non-toxic spray which has been used with good results to aid in the establishment of lucerne plots and other special areas is lime sulphur, mixed at the rate of one part of concentrate to 60 parts of water. As with all contact sprays lime sulphur should be applied with a strong spray pump in such a manner as to hit as many insects as possible. The weakness of most contact insecticides is that they have no residual or repellent action and consequently reinfestation of treated areas soon takes place.

D.D.T. AND BENZENE HEXACHLORIDE.

Both of these insecticides appeared to offer possibilities of control and during the winter of 1947 advantage was taken of an opportunity to carry out a preliminary trial. Both insecticides were used in association with superphosphate and in dusts made up with pryophyllite. The following treatments were laid down:—

1. Control.
2. Four per cent. D.D.T. mixed with superphosphate used at 2 cwt./acre = 4.25 lbs. pp′ isomer per acre.
3. One per cent. D.D.T. dust 50 lbs./acre = 0.5 lbs. pp′ isomer per acre.
4. Four per cent. Benzene Hexachloride mixed with superphosphate used at 2 cwt./acre = 1.165 lbs. α isomer per acre.
5. Two per cent. Benzene Hexachloride dust 50 lbs./acre = 0.13 lbs. α isomer per acre.

The effectiveness of the treatments was evaluated by a sampling technique designed for the purpose and yielding results as a population count at weekly intervals.

As a check against the population count technique, estimations of damage to the pasture were made at regular intervals. The results obtained from these two sets of data were sufficiently correlated to justify the population sampling technique adopted.

The outstanding feature of this trial was the effectiveness of the Benzene Hexachloride in superphosphate treatment and the disappointing results obtained from the D.D.T. superphosphate treatment.

Further experiments are necessary to determine the most economical and effective means of using this material but the results of the above trial point to Benzene Hexachloride as being a very promising insecticide for this purpose.

SUMMARY.

The lucerne flea is an introduced pest widely distributed throughout the agricultural areas of South-Western Australia.

Cultural methods of control involve fallowing, burning and other methods of weed control as well as spring planting of crops such as lucerne.

It is a winter pest and is most serious as a pest of subterrannean clover and lucerne. A certain degree of control is exercised by a predatory mite (*Biscirus lapidarius*).

Lime sulphur is an effective contact spray but has no residual effect.

D.D.T. was not promising for control of this pest but Benzene Hexachloride was sufficiently effective to warrant further experiments with it.

CALTROP.

(*Tribulus terrestris Linn.*)

C. A. GARDNER, Government Botanist, and R. D. ROYCE, Agricultural Adviser.

THE list of native plants which have proved troublesome to farmers and pastoralists in Western Australia is extensive. A large number of these plants, both in the tropical and sub-tropical north, and in the southern agricultural areas are poisonous, while others are troublesome because of the spiny burrs or seeds they produce. Some of the worst burr producing plants are included amongst the species of *Tribulus*, the most widely distributed of which is *Tribulus terrestris* Linn, commonly known as Caltrop, which produces a burr somewhat reminiscent of that of double gee.

Native to the warmer regions of the Old World, including tropical Australia, Caltrop has proved so adaptable to varying conditions of soil and climate, that it is now a serious weed in nearly every warm temperate country in the world, the main factor in its spread being commercial intercourse between various countries. The Australian plants have proved no less adaptable, and the increasing use of motor transport in the areas where it is native, together with movement of stock from the northern to the southern areas of the State, have resulted in the spread of the plant into the agricultural areas.

It has been reported as a weed from several widely separated districts of Western Australia and has always proved completely adaptable to the soil and climate of each area. The plants have invariably been large healthy specimens spreading over several square feet of soil and producing numerous burrs. It is already well established in some localities, and has been declared a noxious weed in the Dalwallinu, Fremantle, Kondinin, Merredin and Mukinbudin Road Board Districts and the Fremantle and East Fremantle Municipalities. Although it is at times of some value as a browsing plant, Caltrop possesses characteristics which far outweigh its dubious fodder value, and it should always be regarded as a serious weed.

Description.—Caltrop is a prostrate annual plant, the stems of which spread along the ground for a distance of one or two feet from the more or less woody tap root. The stems are usually covered with silky hairs, especially on the young parts. The leaves are borne in pairs, one on each side of the stem, and consist of several pairs of leaflets, the upper surface of which is of a darker green than the lower. The leaves of each pair are unequal, one being only half as long as the other, and having fewer leaflets. The flowers arise from the axils of the smaller leaves, and are borne on a short pedicel or stalk. They are pale yellow in colour, and little more than half an inch in diameter, with ten stamens. Below the petals is a small cup-like organ known as the calyx and consisting of five sepals. When the flower fades the ovary develops rapidly, the five sections or carpels becoming hardened and woody, forming a burr, the five carpels united along their central axes, but falling readily when fully mature, but not shedding their seeds. Each burr is about one quarter of an inch long and almost half an inch broad. In cross section each carpel is wedge shaped, with the two inner faces net-veined. On the dorsal surface there are two stout spines set at an angle to the surface and near the top of the burr; on the opposite end are two smaller spines, sometimes very small, and directed downwards, almost at right angles to the larger spines. Between the two pairs of spines, and running the whole length of the outer surface, is a crest of small pointed protuberances or spines. Each carpel contains two to five seeds.

The name *Tribulus* is derived from the Greek "tribolos," and is the Latin name for some spiny plant; and also for the "Caltrop," a spiked metal ball used as a military instrument in war as an impediment to cavalry. The specific name *terrestris* "found on the earth" refers to the prostrate habit of the plant.

Economic Importance.—The thick mat of burrs produced by a well established growth of Caltrop is capable of causing extensive mechanical injury to stock, particularly horses. The points of the spines penetrate the frog of the hoof and cause painful suppurating sores. Pammel[5] has pointed out that when the burrs are ingested along with other herbage, they may cause mechanical injury to the lining and walls of the stomach and intestines. In addition the plant is liable under certain conditions to be toxic, although no losses due to it have yet been reported in this State.

De Koch[6] in South Africa, proved that when eaten by sheep or goats in the wilted state, this plant caused a condition known as Dikoor or Geeldikkop. Photosensitization of the ears, lips and skin surrounding the eyes, followed by swelling of the head, are the typical symptoms as described by the South African investigators, and similar symptoms were reported from two areas of Queensland during 1936.[6] Caltrop was plentiful in the pastures on the properties concerned, and had been freely eaten by the sheep, resulting in heavy stock losses. Weaners appeared to be most severely affected, but sheep of all ages proved to be susceptible. Pastoralists in New South Wales have also experienced losses in areas where Caltrop was plentiful, and had been eaten by the stock.

Hurst[3] states that from New South Wales experience, the plant appears to be toxic only under certain conditions, namely, when green, succulent or rapidly growing plants are grazed during hot days. Sheep are less likely to be affected when the pasture consists of other species mixed with the Caltrop, or when it is past the succulent stage, and is beginning to dry off. Trouble is usually experienced when sheep are grazing the plant during a period of hot weather following heavy showers of rain.

Control.—As with all annuals, Caltrop is dependent on seed production for its propagation, so that if burr formation is prevented over a given area the plant must eventually be eradicated. Any control measures adopted must be directed towards the prevention of flowering, and must therefore be initiated before the flower buds have opened. Persistence and thoroughness over a number of years are necessary, because of the possibility of seeds remaining in the soil in a viable condition.

Prevention is better than cure, and is always more economical. Seeds can be introduced into clean areas on motor vehicles or machinery, particularly those with pneumatic tyres, and in this connection it is interesting to note that both Caltrop and Double gee have been spread over large areas by virtue of their ability to stick to the tyres of aeroplanes. Stock from affected areas frequently carry the burrs adhering to the wool or hair on their legs, while chaff has also been responsible for the spread of the plant. Farmers can do much to prevent the establishment of the weed on their properties by carefully checking on the district of origin of produce or second-hand machinery before purchase, and close personal inspection before accepting delivery on the property. When plants are found on a previously clean area, they should be hand pulled, and, together with the matured burrs that have fallen on the ground, should be placed in a bag and burned. Where one plant is found, others may appear after further showers of rain, so a constant watch should be kept to prevent any burrs from maturing.

Nothing is known of the longevity of the seeds of Caltrop, but American workers[4] report that a plot on which the weed had been firmly established for some time, was kept free of plants for a period of eight years, and seedlings continued to emerge in undiminished quantities throughout the period of the test. It is reasonable to expect, therefore, that they would be capable of retaining their viability for long periods. Thus it would appear that deep ploughing of affected areas, although temporarily disposing of the pest, would only serve to create a store of seeds in the soil which would be capable of germinating at some future date, when brought to the surface by another deep ploughing.

Fortunately deep ploughing should not be necessary as the young seedlings appear to be readily destroyed by even superficial cultivation. Plants commence flowering at an early stage of growth, and, like Double gee, as early as a week or fortnight from germination are capable of flowering and setting seed. Under favourable conditions the plants are capable of producing an enormous number of burrs, and plants may continue to flower into the winter months. The rapid maturing nature of Caltrop plants makes it of particular importance that cultivation should be commenced as soon as the plants appear. As with all problems associated with weed control, energetic measures repeated as soon as weed growth makes it advisable, are the key note of success.

Efficient chemical control of Caltrop is possible at a relatively low cost by the use of diesel oil. American workers[4] have shown that when the oil is used as a spray, it not only kills the green plant, but it is also absorbed by the tissues of the burr and apparently has a toxic effect on the seeds, rendering them non-viable. Unadulterated diesel oil gave more efficient results than oil as an emulsion in water. Unfortunately green burrs do not absorb the oil as readily as mature

ones, while those which are covered with soil at the time of spraying will be unaffected, and will germinate when conditions are suitable. Additional sprays will probably be necessary to kill the plants which germinate from these burrs.

Diesel oil has little cumulative effect on the soil on which it is sprayed, nor is it capable of killing the roots of perennial plants, except by repeated applications. Subsequent growth of both annual and perennial plants will be completely normal on the sprayed areas in the following season.

Explanation of Plate.

A, Habit of plant. B, Leaf (enlarged). C, Flower. D, Upper view of burr. E, Lateral view of burr. F, A separate carpel (lateral view). G, Longitudinal radial section of carpel, showing seeds.

Fremantle, W. Australia. March, 1948.

Farmers normally have quantities of sump oil on their properties, and this substance could be used to good effect in combating small areas of this weed. Like diesel oil it will kill off all the plants which are covered by it, but it is doubtful whether it will penetrate the tissues of the burr and kill the seeds. However, if a good coating of oil is given, and a layer of straw or dried bushes is spread over the patch, the heat of the resulting fire will kill a large percentage of the seeds, if not all of them. The burrs mature rapidly and fall very easily, so that if plants are disturbed at all after the burrs have matured, a large number of them may be scattered over the surface of the soil, and so increase the size of the area affected. Under no circumstances should the plants be raked up into heaps for burning, unless the shed burrs are also carefully collected and destroyed, but should be burned where they grew, individually if necessary.

Chemical weedicides such as sodium chlorate, sodium arsenate and the hormone preparations are effective in killing off the green plants, but they have no effect on matured burrs, and repeated sprayings, probably over a number of years, would be necessary for eradication. Spraying programmes using these preparations would be very expensive and uneconomical.

Summary.—Caltrop is native to Northern Australia and is becoming established in the agricultural area, where it has already been declared a noxious weed in several Road Board Districts.

The spiny burrs are capable of causing mechanical injury to stock.

The plant is toxic to sheep and cattle, mainly when succulent plants are eaten during hot weather. Losses are sometimes heavy.

Control is possible by using diesel oil as a spray; this is effective in killing both the green plants and the matured burrs.

Isolated patches should be burned without being raked into heaps, and burrs should not be buried by deep ploughing.

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RAGWORT.

(*Senecio Jacobaea L.*)

C. A. GARDNER, Government Botanist and R. D. ROYCE, Agricultural Adviser.

THE importance of the early recognition of a serious weed, and its prompt destruction has been demonstrated very clearly in the case of ragwort in Western Australia. In January, 1940, a specimen of ragwort was received at the State Herbarium from the secretary of the Manjimup Road Board, who stated that Mr. J. J. Mottram noticed an unusual plant on his holding, and, suspecting that it might be a weed of some consequence, had handed a specimen to him to be forwarded for determination. This specimen was the first record of ragwort in Western Australia. An officer immediately visited the district to investigate the reported occurrence, and found that the affected area comprised about one hundred

square yards in a pasture paddock where the large trees were dead but still standing. The plants of ragwort were mainly clustered together and had the appearance of having originated from a single, or but few associated plants.

The history of the occurrence of the weed suggested that it had been introduced in pasture seeds from New Zealand, about five years previously. The prompt recognition of the weed by Mr. Mottram, and the interest and co-operation of the road board secretary, resulted in the destruction of the plants before any seed had been formed. Specimens of the weed were deposited with the secretary of the Manjimup Road Board for exhibition, in order that the plant might be recognised by others. The result was the detection of another small occurrence on a property not far removed from the original area. All plants were grubbed and burned, and the areas have been inspected by an officer of the Agricultural Department on several occasions during the subsequent years, but no further plants have been located.

In March of this year, another occurrence was reported, this time from the Walpole district, where Mr. J. B. Amos found a single plant growing on a neighbour's property. Recognising the potentialities of the plant from its growth habit, and suspecting that it would be an objectionable addition to the weeds of the district, he forwarded it to the Department of Agriculture for identification. The seriousness of the new find was at once apparent as the plant was well advanced in flower, and seed formation had already been commenced. Arrangements were made with the Rural and Industries Bank for the Inspector from the Denmark Branch to make a survey of the district in an effort to locate any further plants. Three affected areas were found, one of major importance, the other two showing only scattered plants.

In the large area, on a property recently purchased by the present owner, the plants occurred scattered over the greater part of a two-acre paddock. In one corner, where the original plants had apparently been located, the infestation was quite heavy, and showed signs of the plant's capacity to crowd out pasture species. The thick mat of radical leaves had practically killed the paspalum, and only bracken and other strong-growing weedy types of plants were still able to withstand the competition.

From this original source of infestation, seeds had not only been distributed over the rest of the paddock, but in all probability they had been blown on to the neighbouring properties. Odd plants were found many chains away from the main infestation, and it is probable that many other seeds are lying dormant in the ground and will eventually germinate, so that constant and thorough measures will be necessary for a number of years if the weed is to be eradicated. In a district with such a potential in dairy production, and with so much at stake, the weed is a particular menace, and merits the most vigorous community campaign of destruction.

From the past history of the area, and the present extent of the weed, it is apparent that the original plants must have appeared at about the same time as those reported at Manjimup in 1940. In the one case, however, the possibilities of the plant were recognised fairly early, and its eradication was a comparatively simple matter. At Walpole, on the other hand, nothing was done about the weed, despite the fact that stock were reputedly lost after grazing in the paddock, probably due to the presence of the ragwort. In the intervening years the plants have spread, until now they threaten to take possession of several acres of fertile country, and their eradication will be a major task.

Ragwort has been proclaimed in the *Government Gazette* as a noxious weed for the State of Western Australia, and dairy farmers in the lower South-West are urged to be on the look-out for the plant, and to take immediate steps to eradicate any that are found.

Ragwort is a perennial herb native to Europe, Siberia and North-Western India, but is recorded as a naturalised alien in North America, New Zealand, and Victoria. It is toxic to stock. In New Zealand large areas have become infested —in places to the exclusion of most other vegetation.

In addition to the fact that ragwort is a robust perennial capable of reproducing itself vigorously from its roots, it is also a remarkably free-seeding species adapted for rapid proliferation. The seeds may lie dormant in the soil for some years, and germinate when conditions prove favourable. It is because of this latter characteristic that some years must elapse before complete extermination can be claimed with certainty.

Toxicity.—Ragwort has been proved toxic in Britain, in Canada, New Zealand and Victoria. Horses and cattle are most likely to be affected, and the slow poisoning of dairy cattle has caused much concern. The toxic effect is cumulative. Poisoning under natural conditions is a slow process because an animal does not usually eat enough of the weed at one meal to cause acute poisoning; on the other hand, through its cumulative action the amount of poison which becomes available is sufficient in time to cause very serious symptoms which often end in death. Murnane[1] states that after grazing for twelve months or more on areas where ragwort is plentiful, cattle develop typical symptoms, exhibiting dullness, loss of appetite, and a jaundiced condition of the eyes, together with a peculiar staring appearance. There is loss of weight and, in the case of lactating animals, a very marked diminution of the milk supply. The milk has a peculiar odour and pronounced acrid flavour rendering it quite unfit for use. The affected animal frequently exhibits a scabby condition of the skin, especially in the udder and teats. In the later stages there is impaired vision, staggering gait, persistent diarrhœa, a marked thirst and progressive loss of condition. The milk supply ceases, food is not taken, the animal becomes weaker, drops down and eventually dies—frequently in a swamp or water hole into which it has wandered in order to quench its insatiable thirst.

The actively poisonous agent in the plant appears to be one of two or more alkaloids which have been extracted in more or less pure form from various species of ragwort. It would appear that, although animals which had received a toxic amount of ragwort over a certain period, may seem healthy at the time when feeding on the material is discontinued, they nevertheless develop acute symptoms of poisoning and die at a later period. Thus, in cases investigated in Britain some of the animals did not show definite symptoms until twelve days or more after feeding tests with ragwort had been discontinued[2].

There is no cure for ragwort poisoning, and prevention resolves itself into the eradication of the plant. Sheep are less affected than cattle and horses, and when managed correctly provide a practical measure of control.

Eradication and Control.—The prevention of seed-formation on the plants is a very important factor in the control of ragwort. Where only a few plants occur, careful grubbing represents the safest method of control. The roots and the entire rootstock should be removed, heaped and burned, this operation being carried out before the flowers have expanded, since any flowers present on severed plant parts may develop mature seeds because of the sappy nature of the stems; consequently every part of the plant should be destroyed.

EXPLANATION OF PLATE.

A. Habit of plant showing stock and basal leaves, also the apical portion with stem leaves and flowers. About sixteen inches from the middle has been removed. B. Stock with a rosette of basal crisped leaves. C. Radical leaf. D. Flower-head. E. The same showing the involucre of black-tipped bracts. F. Disc floret. G. Ray floret. H. Fruit ("seed").

Northcliffe, W. Australia. January, 1940.

Since the seeds retain their vitality in the soil for a number of years, one year's seed production will necessitate a careful examination of the infested area for several years after grubbing. Spasmodic cultivation only serves to divide the rootstocks and spread the weed. Any cultural work must be thorough and repeated as often as necessary, and it is important that the affected area should be treated as a unit in this connection.

Where the plant is abundant and widespread, sheep have proved a practical means of control. This method has been attempted in many places in New Zealand with success and has resulted in practically no abnormality amongst the sheep, but, on the other hand, mis-managed efforts on the part of other settlers have resulted in failure with heavy stock losses. Given proper treatment, a measure of control has been secured in two or three years. Very good results have been achieved by stocking heavily with sheep when the ragwort is young and juicy. Small paddocks are desirable, and old animals have been found to be less affected than lambs, and at the same time more severe in their grazing.

Both sodium chlorate and arsenic pentoxide have proved effective when sprayed on ragwort, complete destruction having been obtained from the application of a five per cent. solution of sodium chlorate. This treatment by sodium chlorate has proved more effective during showery weather than during particularly dry weather, and Dean[3] states that as the plant reaches the flowering condition a weaker solution than that required while the plant is actively growing may be used. An application as low as two per cent. has proved effective when applied to plants in flower. The chemical control of weeds is, however, an expensive method, and usually is not economical for large areas.

Description of Plant.—Ragwort grows to a height of from two to three feet, from a short thick rootstock which divides with age. The stems are strictly erect, simple or branched above, and usually a bright purple in colour. Leaves pinnately divided, with ovate, obovate or narrow coarsely toothed or pinnatifid segments, the terminal ones large and confluent, the lower smaller, all glabrous or loosely downy, especially on the lower surface: basal leaves on long petioles, the uppermost sessile. Flowers yellow, in compact or broad terminal corymbs; involucral bracts linear, tipped with dark brown or black points, the outer bracts few and very small. Ray florets yellow, usually 12 to 16 in number, linear-oblong, spreading; disc florets numerous, yellow. Achenes of the disc florets shortly and coarsely hairy, the achenes of the ray florets glabrous.

For further particulars see the accompanying plate. The young plants have dense crisped radical leaves and the thick stock develops early, the stems in the local plants are purple in colour.

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APPLE SCAB OUTBREAKS SEASON 1947-48, WITH SPECIAL REFERENCE TO THE INTRODUCTION OF THE DISEASE BY INFECTED BUDS ON IMPORTED NURSERY STOCK.

W. P. Cass Smith, Government Plant Pathologist.
H. L. Harvey, Assistant Plant Pathologist.
Olga Goss, Assistant Plant Pathologist.

SUMMARY.

Western Australia is one of the few apple growing countries in which apple scab (Venturia inaequalis) is not firmly established. Outbreaks which have occurred here from time to time have been eradicated with great difficulty. Available evidence indicates that these outbreaks have originated from imported nursery stock, and not from diseased fruits introduced contrary to regulations. Measures requiring imported nursery stock to be free of leaves and dipped in Bordeaux mixture have proved ineffective, for after large importations of nursery stock from Victoria and Tasmania in winter, 1947, numerous new apple scab outbreaks developed next season, which were confined to these newly introduced trees or stocks.

Bud-scale infections were demonstrated on Pomme de Neige seedling stocks from Tasmania, and Northern Spy stocks and the Cleopatra variety from Victoria imported during winter 1947. This is a new record for Australia.

Attention is drawn to the discovery in infected buds of two-celled spores and perithecia-like bodies closely resembling the ascospores and perithecia of V. inaequalis. An exact determination could not be made, however, as ripe perithecia containing asci and ascospores were not found.

Control measures recommended for the eradication of the 1947-48 outbreaks are listed and the view is expressed that the best method of excluding apple scab from Western Australia is to propagate and use our own nursery stock.

SINCE 1930 when apple scab was first recorded in the State, several outbreaks of the disease have occurred here, but each has been successfully eradicated. (1, 2 and 3).

Eradication has only been achieved, however, by the stringent measures laid down by the Department of Agriculture and the noteworthy co-operation of growers concerned, in carrying them out conscientiously. That these outbreaks should have occurred is not surprising because the majority of our apple orchards have been planted with nursery stock imported from Victoria where the disease is both serious and widespread.

It is true that the disease, should it become established, would probably never be as serious here as in Tasmania or Victoria, owing to the less suitable climatic conditions for its development, but its control would considerably increase production costs, and might well cause the abandonment of orchards of low productivity.

ORIGIN OF OUTBREAKS IN WESTERN AUSTRALIA

All available evidence indicates that outbreaks of apple scab in this State have originated from nursery stock imported from other places where the disease exists. The introduction of apple fruits is prohibited by regulation under the Plant Diseases Act, and although this is at times contravened unwittingly, no outbreak can definitely be attributed to introduction of diseased fruits.

There are three ways in which apple scab may be introduced with imported nursery stock.

1. by infected twigs or buds.
2. by infected leaves.
3. by superficial spore contamination.

In some countries, e.g. England and Ireland, the apple scab fungus has long been known to over-winter on infected one-year old twigs, and more recently over-wintering by infected buds has also been demonstrated. (4, 5.)

In Australia, however, neither of these modes of carry-over had been recorded up to the commencement of the past season.

As a safeguard from the introduction of the disease by means of infected leaves, and superficial spore contamination, measures prescribed for some years now by Superintendents of Horticulture have required that all apple nursery stock entering Western Australia should be free of leaves, and dipped in strong Bordeaux mixture.

BUD-SCALE INFECTIONS ON NURSERY STOCK IMPORTED DURING WINTER 1947.

During the winter of 1947 large importations of nursery stock were again made, for the first time for several years. These were obtained mainly from Victoria, and to a lesser extent Tasmania, and comprised some 80,000 young apple trees, and seedling or other stocks. Despite the application of the measures mentioned, these importations were followed by further outbreaks of apple scab during the ensuing 1947-48 season, as the disease was detected in twenty-one orchards, and two nurseries.

It is clear that these were in no way connected with any previous outbreaks for no trace of the disease had been found anywhere in Western Australia during the preceding five years despite careful yearly searches, and more significant still *all these new outbreaks developed in young orchards or nurseries, never affected previously with apple scab and the disease was confined entirely to newly planted young trees or stocks imported from Victoria and Tasmania during the winter of* 1947.

The circumstances were such, therefore, that some unusual method of disease introduction was suspected and this was supported subsequently by field observations.

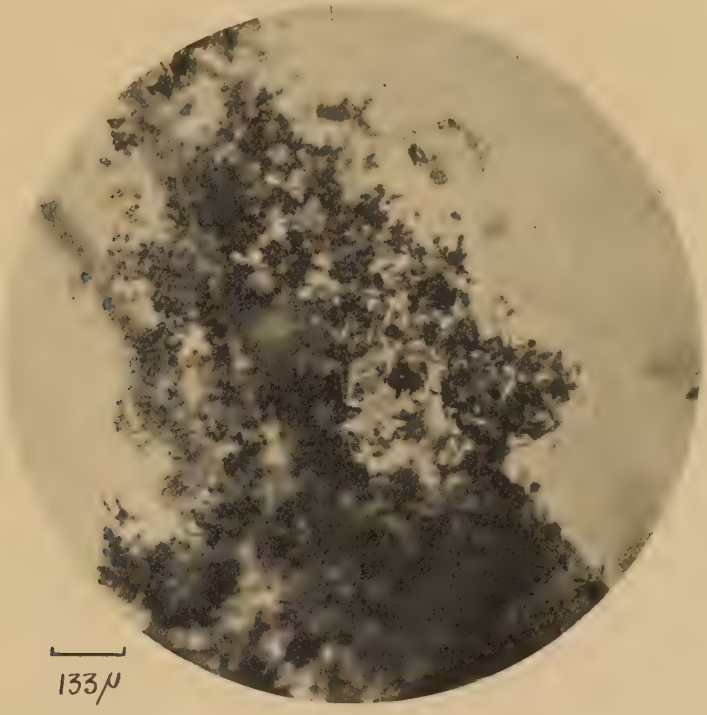

Fig. 1.
Micrograph of infected bud scale, showing the stroma and conidial stage of *V. inaequalis*.

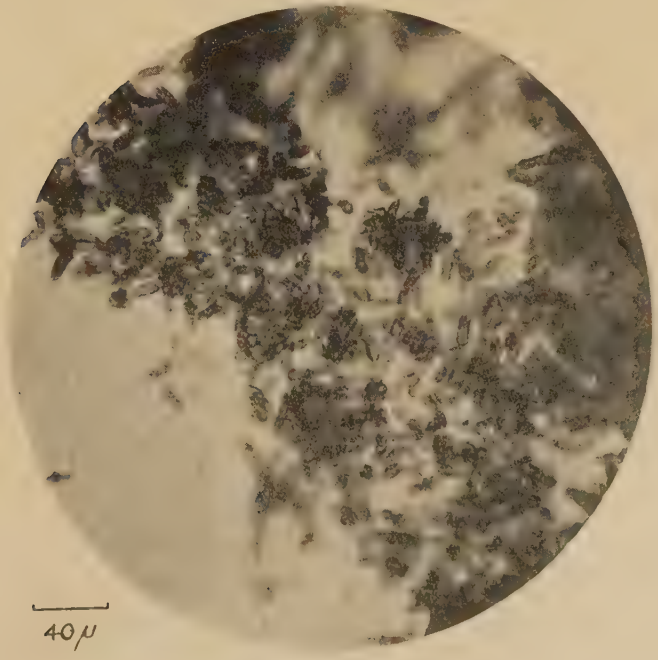

Fig. 2.
Micrograph of infected bud scale showing the typical conidial stage of *V. inaequalis*.

The first outbreak, fortunately, was detected very early in the growing season by a Horticultural Field Officer in a Pemberton nursery. The Assistant Plant Pathologist, Mr. H. L. Harvey, who visited this outbreak, reported that although so early in the season, leaf infection was particularly severe, and that in many cases the whorl of leaves arising from a single bud were all badly infected and distorted even though the leaves were still very immature. Primary symptoms of this kind appeared to be better causally related to infected buds than to infection from over-wintering leaves.

McKay, who has done considerable work on bud-scale infections in Ireland, has recorded similar symptoms, and regards them as being a typical result of primary infection arising from diseased bud scales. (5)

Some hundreds of diseased specimens secured from this and later outbreaks, were therefore laboriously examined microscopically for evidence of twig or bud-scale infections. Twig infections were not seen, but infected dormant buds were detected on Pomme de Neige seedling stocks imported from Tasmania, and on Northern Spy stocks and the Cleopatra variety imported from Victoria.

Dormant buds on apical stems or terminal stem portions were the chief regions where infection was noted, but infected buds were also detected at times at considerably lower levels on the stems.

In the field, also, early leaf symptoms of a type, indicating, it is believed, that infected buds were the primary source of inoculum, were most evident on the growth from terminal or apical buds, according to reports received from Horticultural Officers T. Miller and R. C. Owen.

MICROSCOPIC DETAILS.

Preparation of Slides.

Dormant buds (i.e. those showing no sign of swelling) were treated for examination by boiling in 20% potassium hydroxide, until the bud scales began to separate. Generally this took from 3-5 minutes. They were then well washed in water and transferred to a slide where the bud scales were teased apart and stained in cotton-blue in lacto-phenol.

Conidial Pustules.

Conidial pustules were discovered on some bud scales, both stroma and conidia being abundant. The conidia were typical of *Fusicladium dendriticum* in shape and size, averaging 20 microns x 9 microns (Figs. 1 and 2). Conidia of three types were noted, namely, unicellular, one septate and germinating spores.

The mycelium was of two kinds; brown, septate, unstained mycelium, and dendritically branched stained mycelium.

The fact that some of the spores were septate, and others germinating, and that dark unstained mycelium was present, would seem indicative of age, and hence that the infections were of long standing.

It is noteworthy, however, that stained mycelium was also seen which would indicate that it was still active. In support of this statement, it was noted that in some buds, internal leaf rudiments were found with an occasional spore, and young, stained mycelium showing typical dendritic branching.

? Perithecia and Ascospores.

During the examination of infected bud scales a group of four two-celled spores was discovered. These averaged 12 microns x 6 microns in size and appeared to be typical ascospores of *V. inaequalis* (Fig. 3). Their discovery in this habitat was of great interest, particularly as their occurrence could not be related to discharge from perithecia in over-wintering leaves, in view of the circumstances already explained.

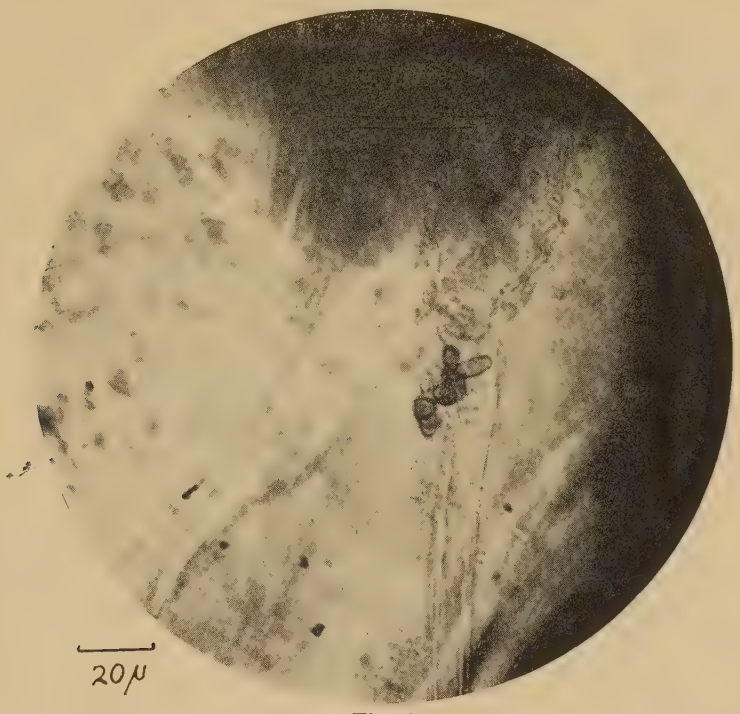

Fig. 3.
Micrograph showing group of two-celled spores closely resembling the ascospores of *V. inaequalis*, found in association with infected bud scales.

A search for perithecia also was therefore made, and ultimately a small number of black, roughly spherical, perithecia-like bodies, closely resembling those of *V. inaequalis*, were found in diseased bud scales showing the conidial stage (Fig. 4.)

The buds in which these were found were very shrunken and appeared dead.

These ? perithecia varied from 72 microns to 120 microns in diameter, possessed short necks, with an occasional spine about the ostiole region. The mycelium surrounding these bodies was very similar to that of the scab fungus and fitted with that seen in bud scales showing the conidial stage (Fig. 5).

Unfortunately, an exact determination could not be made as these perithecia-like bodies proved to be empty, and ripe perithecia containing asci and ascospores were not found.

There appears to be no published record of the occurrence of the perithecia of *V. inaequalis* in bud scales, and, therefore, as the matter was one of importance in connection with our knowledge of the life cycle of the fungus, specimen slides were referred to Dr. S. P. Wiltshire, Director of the Commonwealth Mycological Institute, Kew, London. In his reply, Dr. Wiltshire stated that he "would not venture an identification from the slides alone" . . . . . "Although unable to confirm the presence of perithecia on the bud scales, the conidial state was present in profusion and one would therefore not be at all surprised if the perithecial state occurred as well". It is hoped that by reporting these observations, together with Dr. Wiltshire's comments, interest will be stimulated in countries where apple scab is wide-spread, and bud scale infections occur, which will lead to the clarification of this matter.

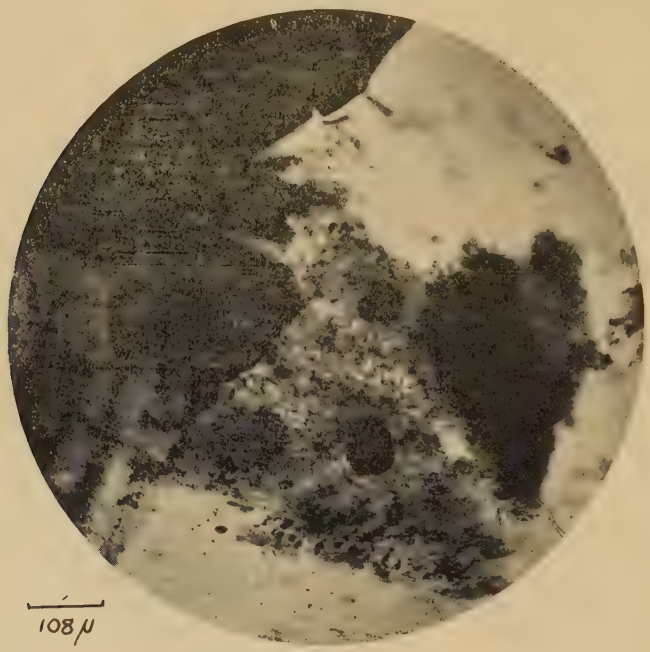

Fig. 4.
Micrograph showing ? perithecia of *V. inaequalis* found in infected bud scales.

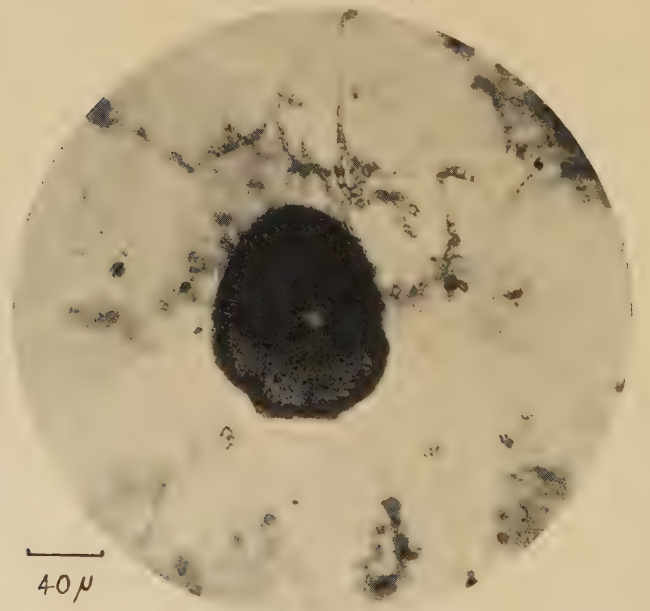

Fig. 5.
Micrograph showing ? perithecium of *V. inaequalis* more highly magnified. Note associated mycelium which is very similar to that of the apple scab fungus, and the conspicuous ostiole. This fruit body is the same as the lowest one shown in Fig. 4.

CONTROL MEASURES.

In view of the early suspicions (later confirmed in the laboratory) regarding the introduction of the disease by infected buds, drastic measures were recommended for the eradication of these outbreaks.

For commercial orchards these recommendations included the complete destruction of plantings of a variety in which apple scab was detected, and the cutting back to basal dormant buds of any adjacent plantings of other varieties.

Complete destruction of diseased plantings of a variety was amply justified, for cutting back to dormant buds might still have yielded infected growth. For nurseries the recommendations included the destruction of all stocks showing the disease, and the cutting back to ground level of the remainder, together with a thorough spraying of the area with a suitable fungicide.

In all, approximately 3,700 young trees or stocks were destroyed by field officers, and some 19,000 trees or stocks cut back.

In the light of this new knowledge on the transmission of the disease by infected buds, the question of further importations of nursery stock from infected areas into Western Australia must be carefully considered.

No treatment is known which will, with certainty, disinfect buds which are diseased, for any treatment capable of doing so would also kill the buds.

Only two alternatives are considered possible, either complete exclusion, or the introduction of nursery stock under quarantine, which would be extremely difficult, if not impossible to carry out.

Undoubtedly, the best method of excluding apple scab from this State, is to propagate and use our own nursery stock, and recently regulations have been promulgated under the Plant Diseases Act, which it is hoped will bring about this result.

ACKNOWLEDGMENT.

Grateful acknowledgement is given to Dr. S. P. Wiltshire, Director of the Commonwealth Mycological Institute, for his examination of, and expression of opinion on, the slides forwarded to him.

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ZINC DEFICIENCY OF FLAX.

W. P. CASS SMITH, Government Plant Pathologist and H. L. HARVEY, Assistant Plant Pathologist.

SUMMARY.

Zinc deficiency of flax was first recorded in 1943 but only became serious in 1945.

Symptoms include dieback of the tip of the young plant, bronze leaf spotting and leaf rosetting, followed in most cases by regrowth of the stunted main stem or production of lateral shoots from the base.

Fertiliser incorporating zinc sulphate applied at planting time yielded healthy plants, and analyses of plants from zinc treated plots showed a much higher zinc content than those which had received no zinc. Straw evaluations also showed improvement in the yield and quality of fibre with zinc applications.

Factors associated with this disorder have been noted.

IN the course of a flax disease survey in 1943 two crops in the early stages of growth showed a "dieback" condition which was diagnosed as being due to zinc deficiency. These were recorded in the Donnybrook and Muradup districts respectively. Analyses of plant samples showed that the zinc content of the diseased plants was approximately only one half of that of the healthy plants. A preliminary trial in which recovery of some of the affected plants was attempted by the application of zinc sulphate was unsuccessful, due probably to the fact that it was applied too late in the season.

Zinc deficiency of flax did not appear to be of economic significance in Western Australia till 1945 when a dieback and stunting of flax crops in the Boyup Brook area was reported to this department. The property of Mr. D. Hack was inspected towards the end of July after some weeks of abnormally heavy rains, when it was noted that more than 50 per cent. of the crop was no taller than about two inches, in contrast with healthy patches which had reached a height of 10 or 12 inches. Most of the affected areas were badly water-logged. The condition was found to be due to zinc deficiency, and surveys made later in the season showed that it was universally present in the flax areas and for the most part serious. Aspects of zinc deficiency of flax in South Australia have been discussed by Adam and Piper (1944) and in Victoria by Millikan (1946).

SYMPTOMS.

The symptoms observed at the above site and subsequently in other crops were in the most severely affected plants, the death of the few topmost leaves and growing point when the seedlings were only an inch or two tall. Associated with this dieback was often found the production of one or two lateral shoots from the axils of the lowermost leaves. All stages of this second growth were seen from the mere swelling of the lateral buds (Fig. 1d) to the elongation of the side shoots up to about two inches. (Figs. 1c and 2a.)

a b c d

Fig. 1.

(a) Rosette of leaves at tip of stunted main stem with bronzing and death of leaves beneath. A well developed side shoot has grown from a lower bud. (b) A rosette of leaves is seen half way up the stem. (c) and (d) Dieback of tips with side shoots developing.

(Photo. by Government Photographer.)

a b c

Fig. 2.

(a) Dieback of main stem with well-developed side shoots. (b) Rosette of leaves nearly halfway up stem shows point where growth was temporarily retarded. (c) Premature leaf drop. A few leaves are showing bronze spots. In (b) and (c) the main shoot has resumed normal growth.

(Photo. by Government Photographer.)

a b c

Fig. 3.

(a) Bronzing and death of leaves just below the tip of the main stem with the production of a side shoot. (b) The tip of the plant sometimes bends over at the point where stem necrosis occurs. (c) Bronze spots on the lower and middle leaves.

(Photo. by Government Photographer.)

a b c

Fig. 4.

(a) An early stage of recommencement of normal growth of the tip beyond the rosette of leaves. (b) and (c) Bronzing and death of leaves and stem near the top of the stem where a rosette of leaves has formed.

(Photo. by Government Photographer.)

An earlier symptom is the bronzing and death of the leaves and stem just below the growing tip, which may also be accompanied by the development of lateral shoots (Fig. 3a). Not uncommonly the tip of the seedling is caused to bend over where this stem necrosis occurs (Fig. 3b).

Apparently the commonly occurring symptom of bronzing and death of the leaves and stem below the top of the plant is preceded by a fairly conspicuous rosetting of the leaves in that area. (Figs. 4b, 4c, 1a.) The rosette would appear to result from the growth being temporarily retarded. If seasonal growing conditions become worse the leaves and stem at that point die, but if they improve the tip proceeds to grow on normally, leaving a curious rosette of leaves on an otherwise normal-looking stem. A plant in which normal tip growth has recommenced but is only in the early stages is seen in Fig. 4a. Fig 2b shows a plant which has grown on about two or three inches beyond the rosette.

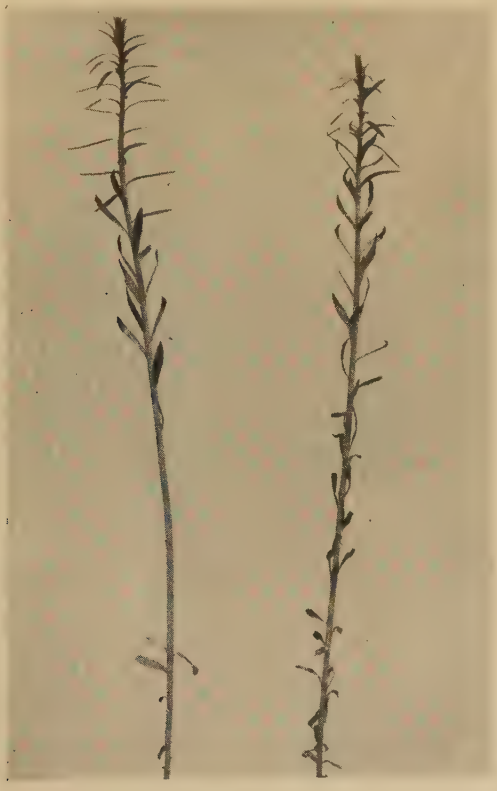

Fig. 5.

"Mild" symptoms of zinc deficiency, namely the occurrence of bronze spots and tips on the leaves followed by a yellowing and premature leaf fall. The height of these plants compares favourably with healthy plants.

(Photo. by Government Photographer.)

A symptom which is not so conspicuous in the field is the occurrence of bronze to black spots on the leaves. It is, of course, often found on plants showing die-back, stunting and rosetting, but quite large patches were seen where none of these severe symptoms occurred. The plants compare favourably in height with healthy plants, but show in the early stages roughly circular bronze spots on the leaves and a bronze colour at various distances back from the tips of the leaves (Fig. 5). This may be followed by a yellowing and premature fall of the affected leaves.

Viewing at a short distance adjacent affected and unaffected patches in the field the bright green colour of the latter contrasted with the dull green of affected patches. Furthermore, where the trouble was very severe the colour tended to be white or sometimes brown if there were a preponderance of young plants with dead tops.

Fig. 6.

Zinc-fertiliser trial at early stage of growth. The sparse and stunted plants in the foreground received superphosphate but no zinc. The taller plants in the strip across the middle of the picture received zinc sulphate at the rate of 15 lb. to the acre in addition to superphosphate.

(Photo. by G. H. Burvill.)

Whereas the above symptoms present an ugly picture during the winter months, a rapid recovery takes places in spring and early summer till at harvest time the difference in growth between zinc-deficient and normal plants becomes less obvious. At this stage one of the side growths has become dominant on plants where the main steam has died back in the early stages and evidence of the original damage becomes much less marked. The average height of such plants was found to be three to five inches shorter than normal plants, and the stand considerably thinner. Other points of difference are set out below in the results of experiments.

ZINC-FERTILISER TRIALS.

An exploratory field trial was conducted in 1946 on the property of Mr. W. Hack to test the effect of applications of zinc fertilisers on the incidence of dieback. The area selected had suffered badly from the trouble in the 1945 season. The trial was laid out in large parallel blocks which were drill-sown and alternate blocks were dressed with super. only and super. with zinc sulphate (15 lb. per acre). In each case the super. was applied at 1 cwt. per acre. Observations made in mid-August showed freedom from dieback in all the zinc-treated blocks, which contrasted with the zinc-deficiency symptoms occurring in the blocks treated with super. only. The contrast was greatest at the lowest end of the experimental area where the ground was excessively wet. Here the zinc-treated plants were six to seven inches in height and almost free from zinc-deficiency symptoms, but where no zinc had been applied most of the plants were suffering from dieback and were only one or two inches high (Fig. 6). Plant samples at this stage of growth were taken from each of the two treatments and results of chemical analyses were:—

Treatment	Zinc (parts per million)
Super only	16
Super + zinc sulphate at 15 lbs. per acre	41

Soil pH* determinations which were made at the same time from the untreated block resulted in pH 6.0 at 0 to 6 inches depth, pH 6.1 at 6 to 21 inches and pH 6.3 at 21 to 30 inches. A number of determinations made on other soils where commercial crops were affected resulted in pH figures of the same order.

Analyses for zinc content were also made on plants taken from affected commercial crops. The results in parts per million of zinc were 16 to 17 for plants showing severe symptoms, viz., dieback, and 22 for "mild" cases, viz., bronze leaf spotting only, as illustrated in Fig. 5.

In mid-November the above experiment was examined and zinc treated blocks were three to five inches taller, more mature, more uniform in height and density of stand, freer from weeds and apparently more uniform and finer in straw diameter. Exact yield data were not obtainable due to damage by stock.

An adjacent trial, however, of similar layout, using only 10 lb. of zinc sulphate per acre, was harvested and the zinc-treated blocks yielded 33 per cent. higher than the remainder. In addition, straw evaluations which were kindly carried out by the C.S.I.R. Flax Research Laboratory, showed that the application of zinc gave an increase in length of straw, in the yield of fibre per ton of straw and improved the grade of fibre. Details of the evaluations are presented in the table hereunder. (Tisdall, 1947.)

*All soil examinations were made by Mr. G. H. Burvill, formerly Plant Nutrition Officer.

STRAW EVALUATIONS

Treatment.	Length (inches)	Appearance.	Ret. Loss per cent.	Fibre Yields per cent Deseeded weight			Grade.	Grader's Remarks.
				Line.	Tow.	Total.		
1. No zinc (control)	30	Greenish yellow. Yellow at butts. Fine diameter. Slight rust present. Less mature than 2. Difficult to deseed.	23·3	22·1	6·4	28·5	C	
2. Zinc.....	33	Greenish yellow. Yellow at butts. Fine diameter, slight rust. Some brownish straws.	21·2	25·9	3·8	29·7	E	Very good l. a

FACTORS ASSOCIATED WITH ZINC DEFICIENCY.

As a result of observations made since zinc dieback was first noticed, a number of factors which contribute to the occurrence of this disorder have been noted.

1. Perhaps the most obvious of these has been excessive soil moisture as in all cases the severity of the symptoms seemed to be in direct proportion to the amount of waterlogging.

2. Length of day also seems to be involved inasmuch as side growth, or growth recommencement of not too badly damaged tips of the main stems, takes place as the days commence to lengthen in August. This even occurs in soil which is still waterlogged. The above photographs, some of which show this regrowth, were taken in mid-August.

3. The types of soil where dieback was most severe were described by Mr. G. H. Burvill as grey to grey brown gritty or gravelly loamy sands to sandy loams with clay at a depth of one to two feet. The deeper reddish loams carried flax that was practically free from dieback.

4. Superphosphate applications have been observed to affect the incidence of dieback. A striking case was noted where a grower had sown a drill strip of flax for a distance of a few chains without superphosphate. Within this strip the plants were free from dieback and stood out in contrast to the severely affected plants on either side which had received the usual dressing of superphosphate.

A detailed investigation of the problem of zinc nutrition of flax is being conducted by the Plant Nutrition Branch of this department.

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PASTURE COMPETITIONS, 1947-48.

AUSTRALIAN DAIRY PRODUCE BOARD PASTURE IMPROVEMENT COMMITTEE.

THE above Committee organised pasture competitions throughout Western Australia with the object of encouraging attention to the development of pastures on dairy farms. In order to ensure that competitions between farm and farm would be on some comparable basis, the State was divided into zones as follows:—

Zone 1—Coastal Area (Muchea to Ludlow River).
Zone 2—Busselton-Augusta.
Zone 3—Donnybrook-Bridgetown.
Zone 4—Manjimup-Pemberton-Northcliffe.
Zone 5—Walpole-Denmark-Albany-Mt. Barker.

In Zone 1, in which is included the irrigation areas, two competitions were conducted—one for irrigated lands and one for dry lands.

It was stipulated that the area entered was to be not less than one acre.

The following prizes were offered by the Committee in each zone:—

First place	5 guineas.
Second place	3 guineas.
Third place	2 guineas.

The scales of points adopted for judging were as follow:—

(a) Pastures on Non-irrigated Lands—	Points.
General appearance, density, evenness of sward ..	40
Botanical composition	20
Freedom from weeds and insect pests	15
Fertilisation	10
Cultural treatment	15
	100

(b) Pastures on Irrigated Lands—	
General appearance, density and evenness of sward ..	40
Botanical composition	20
Freedom from weeds and insect pests	15
Drainage and irrigation	15
Fertilisation and cultural treatment	10
	100

The competitions were conducted under the general direction of the Superintendent of Dairying, Department of Agriculture, whilst judging was carried out by a number of officers in the Dairy Branch.

The results in each zone are as follow:—

Zone 1.

A.—Irrigated Pasture.

Judges: H. G. Elliott and N. R. McKeown.

There were 18 entries, which were judged during October, 1947, and again in February, 1948. Points were allotted at each inspection and the result of both is included in the following table.

DAIRY PRODUCTS MARKETING BOARD PASTURE COMPETITION, 1947-48.

IRRIGATED SECTION—ZONE 1.

Points Allotment—Combined from both Inspections.

Competitor.	General Appearance Density and Evenness.	Botanical Composition.	Freedom from Weeds and Insect Pests.	Drainage and Irrigation.	Fertilisation and Cultural Treatment.	Average Total.
J. Salerian, No. 1., Waroona	37	17	17½	13½	10	91
J. Woodier, Harvey	36½	18	13½	14½	7	89½
J. Salerian, No. 2., Waroona	36½	15	13½	13½	10	88½
J. Hanks, Harvey	35½	17½	13½	14½	6½	87½
L. Hooker, No. 2., Harvey	34½	16	13	14	6	
F. Craig, Dardanup	34	16	13	13	6	82
R. Hanks, Harvey	33½	14½	12½	14½	6½	81½
V. Wright, Brunswick	34½	15½	12	12½	6½	81
L. Hooker, No. 1., Harvey	31½	15½	12½	13½	6	80½
H. McNeil, Waroona	32½	13	13	14	6½	79
L. Damiani, Waterloo	31	15½	12½	13	6	78
Miss Doman, Waroona	31½	12½	12	14½	6½	77
P. Edwards, Waterloo	31	15	13	12	5½	76½
M. Morellini, Dardanup	30	16½	11½	12½	5	75½
F. Reeve, Brunswick	28½	16½	11	13½	5	74½
R. Palmer, Harvey	27½	12	12	12½	5½	69½
V. Robinson, Burekup	25	13	11½	13½	5½	68½
D. Campbell, Brunswick	27½	12	9½	12	5½	66½

The prize-winners were:—

First—Mr. J. Salerian, No. 1 entry, Waroona.

Second—Mr. J. Woodier, Harvey.

Mr. Salerian is to be congratulated on his entries and the excellent way in which he rotates his grazing, fertilises, tops and renovates his pastures. The intervals between grazings vary according to the season and pasture recovery from 14 to 24 days.

Two applications of superphosphate with a maximum of 4 cwt. are given annually. Severe pasture renovation with discs and harrows is carried out in the early winter, while topping and pasture harrowing are also carried out as a routine practice when required.

General Information.

1. Throughout the whole of the irrigation area most farmers are conscious of the value of using certified seed in the mixtures sown.

2. The major species sown are white clover as the dominant legume in association with all or some of the following grasses:—Perennial ryegrass, Cocksfoot and Paspalum. In some instances, a small quantity of Strawberry Clover and/or Lotus Major is added.

3. On most areas judged, couch grass is present and in many there is some encroachment of annual grasses and clovers, more particularly Spear and Wimmera ryegrass, sub and Drooping Flowered and suckling clovers.

4. Weeds.—On recently sown areas, particularly autumn sown fields, Cape weed has a tendency to dominate in the first year. The major weed was Umbrella grass (Cyprus sp.) in the Brunswick-Roelands district. This weed is becoming very serious in this district.

Sedges, docks, sorrel and flat weed occur in certain areas, and very little is being done by farmers to control these weeds.

5. Although not recommended for the irrigation areas, on quite a few fields kikuyu was observed. This grass, unless very rigorously managed, mats and becomes absolutely dominant, and finally becomes low in production.

6. In many cases, land was sown to pasture without sufficient preparation.

7. Management of the irrigated pastures as a general rule was not good. Very little renovation is carried out—in some instances topping is not done or only once in the season, and grazing is very haphazard. Heavy autumn and winter grazing, light spring grazing and reasonable summer grazing, is the general rule. The practice of leaving irrigated fields for hay and cutting late in spring is not a good one, as it seriously retards the regrowth of white clover and sometimes reduces the stand of it and Cocksfoot, allowing couch and paspalum to take charge.

8. As a general rule, superphosphate is applied twice per annum, in the early autumn and spring, up to 5 cwt. being applied annually.

9. Irrigation.—Nearly all the pastures judged in the competition had been laid down in long strips or borders on graded land. In one or two instances, the pastures were watered by the furrow method on land not well graded.

10. Drainage.—During the first inspection in the latter part of the winter, it was noted that quite a number of farmers had not cleaned out their drains to enable the free movement of water. Consequently, in certain sections of the fields, some waterlogging had occurred and in odd places water had lain on the area for considerable periods, thereby reducing the stand of ryegrass, white clover and cocksfoot.

In the second inspection, these areas were very noticeable, as they carried staggy paspalum only. Where grading had taken place with land prior to sowing down for irrigation, much better control of winter water had taken place.

11. Grazing.—Much damage with respect to subsequent carrying capacity is done on the average irrigation pastures inspected by over-grazing in the late autumn and winter months.

This over-grazing retards the recovery of perennial ryegrass, cocksfoot and white clover.

During the late spring months, under-grazing is the general rule, with a consequence that a heavy mat of pasture is produced which is not effectively utilised, as much deterioration occurs to the material produced, which is semi-rotted near the ground level.

Extreme care should be taken with grazing from the beginning of April onwards, as over-grazing between April and August will cause not only deterioration of the pasture species, but also cause weeds to gain a foot-hold over the bareness which occurs through over-grazing.

Grazing, during the spring and early summer months, should be controlled sufficiently well to prevent excess of bulk being produced during those months. The time between grazing should vary according to seasons and rate of recovery, and the periods might vary from 14 days when maximum growth is taking place, to 30-35 days when the pastures are at their last growing stage.

Zone 1.

B.—Dry Land (Non-irrigated) Pasture.

Judges: H. G. Elliott and N. R. McKeown.

	General Appearance.	Botanical Composition.	Freedom from Weeds and Insects.	Fertilisation.	Cultivation	Total.
	40	20	15	10	15	100
J. Salerian, Waroona	38	17	13	10	15	93
R. McNeil, Waroona	39	18	13	10	12	92
J. Lowe, Harvey	35	13	13	10	12	83
C. Piggott, Brunswick	35	12	12	10	13	82
F.W. Leaver, Byford, (1)	30	14	11	10	10	75
C. W. Ward, Waroona	35	15	10	9	5	74
C. Piggott, Brunswick (2)	26	12	12	10	13	73
R. Palmer, Harvey....	30	13	13	9	5	70
F.W. Leaver, Byford, (2)	28	11....	9	10	10	68
E. W. Jones, Harvey....	30	10	14	8	....	62
McLeod, Waroona	25	13	10	9	....	52

The winning and runner-up entries submitted by Messrs. Salerian and McNeil, both of Waroona, were particularly good production pastures, and at the time of judging were very well presented, as both were a little over a week since last grazed. Although Mr. McNeil gained higher points in general appearance and botanical composition for his pasture, Mr. Salerian gained maximum points for cultivation and renovation.

Hereunder are the comments on the individual plots entered for this competition:—

J. Salerian, Waroona (93 points).

An area of three acres in a five-acre field was judged. The pasture was sown down in 1942 with a mixture consisting of sub-clover, mid-season phalaris tuberosa and a little perennial ryegrass, and since planting some encroachment over the whole area has occurred with paspalum. Prior to planting, the whole area had grown two crops of potatoes and one of oats.

At the time of inspection, the pasture was approximately 6in. high, even, vigorous with excellent colour, and had an excellent proportion of grasses, i.e., phalaris tuberosa, perennial ryegrass and paspalum, with mid-season sub-clover. Other minor clovers and grasses were present in odd places.

The whole area receives one bag super. in the autumn and one bag in the spring. Renovation by using a sunprong and pasture harrows is carried out annually in early June and pasture harrows are used during the early spring. No weeds were present, and slight damage occurred from Red Mite and Lucerne Flea.

R. McNeil, Waroona (92 points).

This pasture consisted of paspalum, perennial and Wimmera ryegrass and sub-clover, with a couch base. Two acres of a larger field were selected. The pasture was uniform in height to 6in., vigorous in growth and of excellent colour. Red Mite was causing some damage, and a little Cape weed occurred in isolated spots. Heavy fertilisation up to three bags super. is given annually, and the whole area had been seeded down following a potato crop.

J. Lowe, Harvey (83 points).

This was a particularly vigorous pasture, consisting of white-seeded sub-clover with Wimmera ryegrass. Sub-clover dominated the sward. Super at rate of 2½ cwt. was applied in the autumn.

C. Piggott, Brunswick (1) (82 points).

The area of the paddock was approximately eight acres; carried a heavy stand of "Yarloop" white-seeded subterranean clover with a small quantity of perennial ryegrass, plus some minor species such as lotus and annual grasses.

The soil consisted of wet, puggy clay and the paddock had been closed to stock since the end of June. The clover generally was very heavy and it was estimated that the paddock would cut in the vicinity of three tons of hay per acre. The area had been established approximately three years, and topdressed annually with one bag of superphosphate in the autumn and an additional one cwt. in the spring.

Annual renovation was carried out in the late autumn, using a bush-hog cultivator followed by light harrows.

F. W. Leaver, Byford (1) (75 points).

This pasture consisted of phalaris and subterranean clover which contained many other annual grasses and clover species. Unfortunately, the subterranean clover had not re-generated well and gave an uneven stand.

Over most of the area the phalaris tuberosa was doing well, but was concentrated more towards the furrows than on the main lands. Generally, the pasture was not vigorous, although 2 cwt. of superphosphate had been given annually.

There was a considerable amount of Red Mite and Lucerne Flea and the main weeds consisted of odd docks and flat weed.

C. W. Ward, Waroona (74 points).

Paddock inspected for the competition consisted of a mixture of paspalum, Wimmera ryegrass, subterranean clover with a little drooping-flowered clover, lotus hispidus and annual grasses.

The area had not been grazed for approximately five weeks, and was relatively uniform. The main weeds consisted of Iris, docks and flat weeds.

The area had been topdressed with approximately 2 cwt. of superphosphate in the autumn but had not received any cultural treatment.

C. Piggott, Brunswick (2) (73 points).

The area consisted of approximately four acres, which had been established four years.

This area consisted of "Yarloop" white-seeded subterranean clover with a little perennial ryegrass and odd annual grasses.

Apart from fertilisation and cultivation, which were the same, some winter grazing had been tried out on the area and had proved unsuccessful, the sward being badly damaged by poaching and the general appearance and condition of the clover being markedly inferior to entry No. (1).

R. Palmer, Harvey (70 points).

The area of approximately eight acres consisted mainly of mid-season subterranean clover, with a little ryegrass and a base of couch.

The main weeds were odd docks and flat weed, and quite a considerable amount of damage had been done in the earlier periods to the subterranean clover by Red Mite and Lucerne Flea. The area had not been renovated, but was fertilised at the rate of one bag superphosphate per acre.

F. W. Leaver, Byford (2) (68 points).

The area of 10 acres, consisting of perennial ryegrass and subterranean clover, was not a particularly uniform stand, as the association of ryegrass and clover was poor in sections. The recovery of mid-season subterranean clover was not good after establishment of ryegrass. The main weeds consisted of flat weed and odd docks. The area had been fertilised at the rate of 2 cwt. superphosphate per acre.

E. W. Jones, Harvey (62 points).

Approximately 10 acres of white-seeded subterranean clover.

Practically a pure stand, the only adulteration being of odd plants of drooping-flowered clover. No grass had yet been introduced and the stand was only two years old. The pasture had been established on an area comprised of very heavy wet clayey soil which tended to become extremely waterlogged in the wintertime. Annual dressing of 2 cwt. per acre had been given.

Mr. McLeod, Waroona (52 points).

Area consisted of approximately four acres of subterranean clover and ryegrass, with a little drooping-flowered clover and other annual grass species. Sward was most uneven and had not been grazed for approximately six weeks.

The clover was showing the effects of Red Mite and Lucerne Flea and the main weeds were rushes and docks. The area had been fertilised annually at the rate of one bag of superphosphate, no renovation having been given during period since establishment.

Zone 2.

BUSSELTON—AUGUSTA.

Judges: A. L. Hamilton, Dairy Adviser, Busselton, and V. B. Monti, Dairy Supervisor, Margaret River.

The details of the points awarded are as follows:—

Competitor.	General Appearance.	Botanical Composition.	Freedom from Weeds and Insect Pests.	Fertilisation.	Cultivation.	Total.
	40	20	15	10	15	100
G. M. Smith, Jindong	35	18	12	10	15	90
D O. Briggs, Metricup	35	15	8	10	15	83
F. A. Wilkinson, Jindong	30	15	10	10	15	80
J. B. Clark, Yelverton	30	15	8	10	15	78
G. Crooke, Cowaramup	30	18	5	8	7½	68½

The following comments were submitted by the judges:—

G. M. Smith, Jindong (90 points).

This plot was originally sown as a trial area of phalaris tuberosa three years ago. The soil is of grey sandy loam which previously grew jarrah and marri at one end, fading into rather wet country support—some paper-bark ti tree at the other end. The phalaris had made excellent growth, with a good ground cover of sub-clover. In addition, perennial ryegrass and a small proportion of Yorkshire fog was making good growth. The plot received copper sulphate at the rate of 10 lbs. and super. at the rate of approximately 150 lbs., in the first year of establishment, and 6 lbs. copper and the same rate of super. in the second year. Very little weed growth was to be seen, but a light infestation of red-legged earth mite was apparent.

D. O. Briggs, Metricup (83 points).

A section of a pasture paddock was selected as the entry on this property. The soil was a grey sandy nature, previously supporting marri and jarrah. The selected area had no special treatment during the year, but had received an average dressing of super. and copper sulphate in common with the other pasture paddocks on the farm. This paddock was cut for hay two years ago.

The botanical composition comprised sub-clover, lotus major, paspalum, and perennial ryegrass, with some patches of kikuyu. A factor which reduced the points allocated for this plot was a scattered infestation of dock, and the presence of red-legged earth mite, which had caused considerable damage.

F. A. Wilkinson, Jindong (80 points).

This area was chosen by Mr. Wilkinson as an example of pasture improvement. Three years ago the paddock was covered with spear and silver grass, and quite void of clovers. Renovation comprised cultivation with discs and sowing sub-clover, with the application of one bag of super. and 20 lbs. copper sulphate per acre. In the second year the paddock was again disked and topdressed with super-phosphate.

The growth of sub-clover was particularly good, but from the permanent pasture point of view, the plot lacked the balance which would be provided with the incorporation of a good grass. Red-legged earth mite damage was fairly severe.

The soil type was a red brown sandy loam, previously supporting jarrah and marri.

J. B. Clark, Yelverton (78 points).

The plot selected comprised portion of an oat crop sown for hay, as the permanent pasture on the farm had not come up to expectations. The ground cover consisted of sub-clover, lotus species, hop clover, and the crop generally was free from pests and weeds. This area did not compare with the other entries, however, from the permanent pasture point of view.

G. Crooke, Cowaramup.

The plot is the bull paddock and is founded on a grey sandy loam. The coverage was heavy but, as will be seen from the botanical composition and the light grazing, the height of the sward was uneven. The composition of the plot was as follows, in order of dominancy:—Sub-clover, ryegrass, paspalum, fog grass, lotus major and odd plants of white Dutch. There was no evidence of parasitism, but docks were present in fair numbers. Fertilisation consisted of one application a year of two cwt. of superphosphate, with copper every fourth year. The plot was laid down 12 years ago and has only been pasture harrowed since.

Zone 3.

Donnybrook-Bridgetown.

Judge: K. W. Simes, Dairy Instructor, Bridgetown.

The point allotments made by the judge are as under:—

Competitor.	General Appearance.	Botanical Composition.	Freedom from Weeds and Insect Pests.	Fertilisation.	Cultivation.	Total.
	40	20	15	10	15	100
S. C. Maidment, (1), Balingup	34	15	12	9	15	85
J. V. Dunnett, Nannup	34	15	12	7	8	76
S. C. Maidment, (3), Balingup	31	12	13	9	10	75
S. C. Maidment, (2), Balingup	28	13	13	6	12	72
K. Slattery, (1), Winnijup	35	16	10	7	....	68
K. Slattery, (2), Winnijup	32	17	12	7	....	68
Moyes & Son, Bridgetown	28	14	13	10	....	65
R. Brazier, Kirup	31	15	12	7	....	65
G. White, (1), Balingup	30	15	12	7	....	64
G. White, (3), Balingup	29	16	11	7	....	63
J. Gale, E. Nannup	30	8	10	6	8	62
J. Miller, (1) Nannup....	28	17	10	6	....	61
J. Dowrick, Mallalyup	30	10	12	8	....	60
J. Miller, (2), Nannup	29	15	10	6	....	60
J. Pearson, E. Nannup	27	12	10	7	....	56
P. Plozza, Cundinup....	30	8	10	6	....	54
G. White, (2), Balingup	27	12	5	10	....	54
J. & C. Williams, Bridgetown	25	11	10	7	....	53

Some details of each entry are given below.

S. C. Maidment, Balingup, No. 1 Plot (See report 105/44, 12/11/47).

No. 2 Plot.—A kikuyu cover which was sown from runners planted by hand in June, 1940. The rows were seven feet apart. The area was sunpronged in the February of 1947, treated with 150 lbs. super., and further chain harrowed in the months of June, July, August and October. The sward was uneven, inclined to be patchy and showed the effects of frost. Odd plants of dock were noticed.

No. 3 Plot.—Another kikuyu sward on semi-moist land. This entry was more even, the clover was inclined to show some unevenness in distribution, but nevertheless the general appearance of the cover was most pleasing. Further comments are contained in report of 12/11/47.

J. V. Dunnett, Nannup.

The plot comprised phalaris, sub-clover, a little perennial rye and a sprinkling of the more inferior grasses and clovers. The cover was very free of insect pests, appeared very even, was a nice colour and well conditioned. Further comments in report of 12/11/47.

K. Slattery, Winnijup.

No. 1 Plot.—The acre was sown to P. tuberosa, lucerne and sub-clover in the autumn of 1939; since then the only treatment has been one bag of super., applied in the autumn of each season. The pasture carried a heavy bulk of feed which, owing to the very wet season, was weighed down with the moisture, causing the lower portions of the plants to form a mat on the ground and rot. These conditions were ideal for the red mite and lucerne flea, evidence of their attacks being very much to the fore in the general appearance. The lucerne appeared to have died out over a period of years and weed infestation was fairly heavy.

No. 2 Plot.—The area was ploughed and sown to lucerne in 1939, since then the plants have been reduced in numbers and the P. tuberosa from the adjoining area has encroached to become the dominant pasture plant. The cover was uneven, carried a considerable amount of weed, and showed the ravages of insects.

Moyes and Son, Bridgetown.

An acre was selected in a field which had been sown to clovers, Y. fog, paspalum and perennial rye some 20 years ago, and which served to carry the stock until well into the summer months. Where the soil was damp and the moisture close to the surface, the pasture was reasonably dense and even, retaining a growth akin to the original sowing. Moving over the area it was seen that the fog grass was about the only plant to persist. Weeds, too, occupied a fair percentage of the cover. The treatment of the pasture was with super., one bag in the early winter and another in the early spring.

R. Brazier, Kirup.

A semi-moist area which had been rejuvenated in the spring of 1945 with sowings of perennial rye, mid and Tallarook clover, Albino and N.Z. wild white clovers, super. at the rate of one bag per acre was broadcast at the time of sowing, and treated similarly each season. The cover appeared nicely conditioned, was well grown and fairly free of insects; unfortunately it was very patchy and carried too much weed.

G. White, Balingup.

No. 1 Plot.—The area sown in 1938 showed to contain approximately one-third P. tuberosa, one-third sub-clover and the balance weed. The cover was uneven, not very dense, and in some places inclined to be rank. Treatment in past years has been one bag of super. applied in the early autumn.

No. 2 Plot.—Tallarook clover, which was sown in 1945. The area was previously put down to P. tuberosa, but appeared not to have "taken." The clover showed to advantage, was very dense and fairly even over the entire area. It was fairly free of weeds and insects, but the pasture was over-run with fern growth. The treatment was one bag of super. in the early autumn with a like amount applied in the early spring.

G. White, Balingup.

No. 3 Plot.—Sown on some early developed semi-moist land. The pasture in the main consisted of perennial ryegrass, kikuyu, sub-clover with a sprinkling of the more inferior types of clover and grasses. The area received super. at the rate of one bag per acre in the early autumn. The area was patchy, somewhat uneven and carried a large percentage of weed, principally dock and wild turnip.

J. Gale, E. Nannup.

Entered an acre of sub-clover. As an experiment, one corner of the area had been treated with copper and the results were self evident in the improved growth noticed in that position. Super. at the rate of 1¼ bags per acre was applied in two applications during the year; the area had also been harrowed each year. The pasture was uneven and carried too much weed.

J. Miller, Nannup.

No. 1 Plot.—The area of semi-moist land was developed in 1941 and sown to clover, water couch, kikuyu, lotus major and paspalum. The sward was fairly dense, but too uneven, with water holes carrying light rush growth. The distribution of the mixture, too, was uneven, and the grasses did not appear well developed. The only treatment was one bag of super. per acre. Had this area been worked and renovated, it would have presented a more pleasing picture.

No. 2 Plot.—Kikuyu was the main pasture, with a sprinkling of paspalum and couch. The cover was most uneven, patchy, and showed too much weed in the form of dock. One bag of super. per acre.

J. Dowrick, Mullalyup.

Showed an area of one acre which was sown to mid season sub about eight years ago. Treatment over recent years—one bag of super. applied in the autumn, plus copper (total copper now amounts to 25 lb. per annum). The area was rolled for seed in 1944 and 1945. The cover was fairly even but lacked density. Rye was included in the original sowing, but it did not persist. Some weed was noticeable.

J. Pearson, E. Nannup.

A very old pasture, comprising couch with a sprinkling of paspalum, clover and fog grass. The whole was very uneven and lacked density. Super—¾ bag early autumn and ½ bag in the spring.

P. Plozza, Cundinup.

A sub-clover pasture showing 50 per cent. native grasses and weed. Very poor.

J. & C. Williams, Bridgetown.

An old area that had been sown to P. tuberosa a considerable number of years. The phalaris appears to have died out, as only odd plants were to be seen here and there. Rye-grass was noticed in odd places. The cover was very thin and lacked density. The area had been treated with one bag of super. per acre in one application.

Zone 4.

Manjimup-Pemberton-Northcliffe.

Judge: J. T. M. McNally, Dairy Adviser, Manjimup.

The following table sets out the points awarded to each entry:—

Competitor.	General Appearance.	Botanical Composition.	Freedom from Weeds and Insects.	Fertilisation.	Cultivation.	Total.
	40	20	15	10	15	100
J. Bashford, Northcliffe	37	18	12	8	14	89
A. J. S. Angel, Jardee	37	18	12	8	13	88
W. Beard, Manjimup	35	17	12	9	13	86
J. O. Shepherd, Appadene	32	18	12	7	13	82
J. Heathcote, Northcliffe	30	18	9	8	10	75
J. T. Downes, Northcliffe	26	16	8	7	10	67
J. J. Littlefair, Pemberton	25	10	8	6	10	59

The following comments were submitted by the judge:—

J. Bashford, Northcliffe.

Entry 15 acres of flat country—well-drained. General appearance was very good and indications are for a very heavy crop of hay. Pastures consisted of a very even mixture of perennial rye-grass, paspalum, droop-head, white Dutch and subterranean clovers, Lotus major and kikuyu with some yellow suckling clover and Yorkshire Fog. Weed growth was light, comprising docks and sorrell and there was some mite and flea present.

Fertilisation comprised 1 cwt. super. in March, 1 cwt. in August. Copper was previously applied at rate of 10 lb. per acre. No farm yard manure was carted, but droppings were harrowed in every six weeks during season.

A. J. S. Angel, Jardee.

Moist flat land, totally cleared. General appearance was good, grazing had been carried out at various intervals during the season and on inspection pasture was a couple of inches long, fairly even and dense. Pasture species comprised paspalum, white Dutch clover, subterranean clover, ryegrass and Kikuyu with a few minor species. Rye and kikuyu were not well distributed. Weed growth was sparse, but red mite were present in varying quantities. Pasture harrows were used twice during the growing period.

Fertilsation comprised 1½ cwt. super. in autumn and 1½ cwt. in spring. No farm yard manure was used other than droppings direct on the pastures.

W. Beard, Manjimup.

Land, a gentle slope originally timbered with karri, jarrah and red gum. Area totally cleared. Pasture harrows used frequently. Cutting has been carried out every year over 15 years and now appears to be affecting the colour and strength of the pasture. Pasture species comprised kikuyu, subterranean, strawberry, hop, suckling and drooping-flowered clovers, sweet vernal, rye-grass, paspalum, trefoil, Yorkshire fog and a number of minor varieties. Yorkshire fog is fairly heavy, other species are not as well mixed as in former years. Weed growth is sparse but red mite was prevalent.

Fertilisation—one bag of super. in the autumn. Farm yard manure is spread over each paddock once in every three years.

J. O. Shepherd, Appadene.

This entry was the plot of Phalaris tuberosa planted during 1945. Pasture harrows were used twice during the season. The general appearance was patchy, colour varied from dark to light green. Rabbits had attacked parts. Pasture species comprised Phalaris tuberosa, subterranean clover, lotus rye and silver grasses, wild oats and a few minor species. The general distribution of species was erratic and on some areas the density was patchy. Weed growth was light. Red mite were present.

Fertilisation.—No superphosphate was applied this season, but heavy dressings were given during the last few seasons. In 1947, 16 lb. sulphate copper was applied. No cow manure applied other than droppings during grazing.

J. T. Downes, Northcliffe.

A moist slope, originally carrying mixed timber and undergrowth. General appearance was patchy, suggesting that the use of pasture harrows would be well worth while. Pastures comprised paspalum, drooping-flowered clover, subterranean clover, kikuyu, lotus major, rye-grass and suckling clover. These were not well-mixed and numbers of bare patches were visible throughout the paddock. Weed growth was not heavy. Red mite and lucerne flea were bad.

Fertilisation consisted of one bag of superphosphate, plus five lb. of copper per acre, sown in the autumn. No farm yard manure other than droppings was applied.

J. Heathcote, Northcliffe.

The area submitted was the Phalaris rye-grass plot of the former competition. The present pasture species comprise Phalaris, rye-grass, cocksfoot, subterranean and suckling clovers but the distribution of the species is patchy.

Weed growth is not heavy and is made up of a few docks and some sorrel. Lucerne flea is exceptionally bad and red mite is present.

Fertilisation consisted of one bag superphosphate per acre, autumn application. No farm yard manure, other than droppings during grazing was applied. Pasture harrows are not used.

J. J. Littlefair, Pemberton.

The plot was on a karri slope and had been cultivated, harrowed and planted in May, with Wimmera rye-grass and subterranean clover. The density is very light, irregular and poor in appearance. Some lotus is mixed with the rye-grass and clover. Docks and bracken are very bad. There are infestations of lucerne flea and red mite.

Fertilisation was one bag superphosphate in the autumn and one bag in the spring. No farmyard manure other than droppings during grazing was applied. No pasture harrowing took place.

ZONE 5.

WALPOLE-DENMARK-ALBANY-MOUNT BARKER.

Judge.—C. W. Tobin, Dairy Instructor, Denmark.

The Judge's decision on the scale of points laid down is shown in the following table :—

Competitor.	General Appearance.	Botanical Composition.	Freedom from Weeds and Insects.	Fertilisation.	Cultivation.	Total.
	40	20	15	10	15	100
F. Pease, Torbay	37	18	13	9	14	91
R. B. Wilkinson, King River	35	17	12	10	14	88
J. Wilkinson, Kronkup	35	18	11	8	14	86

Mr. Tobin has made the following report:—

F. Pease, Torbay.

Dense perennial and Wimmera rye-grass and subterranean clover. Little paspalum and drooping flowered clover. Approximate proportion 60 per cent. grasses, 40 per cent. clovers. Very healthy, clean, well-managed pasture on 11-year jarrah-red gum soil. General absence of weeds or poor type grasses most striking. One or two docks only.

Fertiliser: One bag super. per acre.

R. B. Wilkinson, King River.

Good cover strawberry clover, lotus major, little subterranean clover, with well-established paspalum and Yorkshire fog. Little perennial rye-grass, sweet vernal and lamb's tongue. Good mixture of late varieties. Sward slightly uneven and carrying few weeds. Pasture on moist 13-year bottlebrush country. Well managed.

Fertiliser: 1½ bags super. per acre.

Note.—This crop is not so well advanced because moist land growth is generally later this year. It will probably be better early January.

J. Wilkinson, Kronkup.

Even cover of Wimmera and perennial rye-grass and subterranean clover. Little Yorkshire fog, lotus major and minor, with some kikuyu at one end. Well-balanced pasture. Density is weak, probably due to management as a sheep grazing proposition. May be improved with heavier superphosphate dressing. Little silver grass, sorrel and flatweed. Land is very old, semi-swamp.

Fertiliser: Ninety lb. potato manure per acre.

The entries are considered to be the three best-balanced pastures seen in the district this season. A few points were lost for density and evenness by the second and third placed entries, but this should not discourage the farmers concerned, as it is believed this can be remedied by closer attention to fertilisation and management with regard to stocking.

Weed growth was responsible for the loss of a few points and this, too, can be obviated without very much effort. Where there are only a few large weeds, such as dock, they should be pulled before they seed. The smaller weeds appear to be smothered out by a dense cover of clover and grasses.

The winning entry is a good example of well-balanced, clean, well-managed pasture and is a credit to the owner.

FRUIT AND VEGETABLE SHIPMENTS TO SINGAPORE.

A Report By H. R. POWEL, Superintendent of Horticulture.

PRIMARILY at the request of the Central Citrus Council, arrangements were made for me to visit Singapore for the purpose of inquiring into various phases of the fruit export trade from this State. The Department of Commerce and Agriculture which administers the Exports (Fresh Fruit) Regulations agreed to equally share the expenses incurred, provided that the inquiries were made on an Australian basis and that the reports would be available to all States. This arrangement greatly facilitated my investigations as every possible assistance was given to me by the Australian Trade Commissioner in Singapore, Mr. J. Payne.

I left Fremantle on the M.V. "Charon" on the 5th November, 1947, and returned to Fremantle on the M.V. "Gorgon" on the 13th December, 1947.

The purpose of the visit was, firstly to obtain first hand knowledge of the conditions under which the non-frigerated cargoes of fruit travel, secondly, to ascertain the condition on arrival of shipments from Australia, thirdly, to obtain information as to the quality standards observed by other exporting countries on this market and, lastly, by observing the difficulties under which Australian exporters are placed to suggest possible improvements.

Reports have been made on certain fruits and vegetables which are included in this article and it is hoped that the others will be completed in the near future.

Acknowledgments to those persons who assisted me will be made when the whole report is completed, but I would at this stage like to express my thanks to Mr. L. H. Lewington, the Shipping Manager of Dalgety & Co. the Agents of the Blue Funnell Line, who made the voyage to Singapore with me and to Capt. Marriott of the M.V "Charon" and his officers, particularly Mr. Vaughan, the First Officer. Through their co-operation I was able to record particular weather data at regular times each day and free access to the fruit carried on deck and the lower 'tween deck was always permitted.

GRAPES.

Inquiries concerning grapes were made with importers and agents in the course of specific inquiries associated with other fruit and vegetables.

The oustanding impression obtained was the popularity of the green skinned variety Ohanez, and to a somewhat lesser extent Bridal's supplied by Western Australian exporters. Together with Granny Smith apples, these fruits are by far the most popular Australian fruits in Singapore.

Dealers stated that the Chinese, particularly, wanted green varieties and that the colour itself was important to them. A number of inquiries were made as to why such an interest was shown in the colour, but the nearest I could get to it was that green means a 'prime stage' and thus in some way is related to condition and to something that will keep.

During my visit, American Ohanez, known as Almerias were being sold in the vicinity of $45 (£6 10s. 0d.) a box. These boxes contain 32 lbs. net. I was told that the wealthy Chinese buy them and are not greatly concerned with the cost. The coloured varieties are largely consumed by the European population and the retail price is very much lower.

Ohanez grapes are often cool stored for considerable periods after they have been unloaded. One instance was mentioned to me by a dealer who cool stored his grapes last year until December and then sold them at the handsome price of $65 (£9) a box. I understand that it is a common practice to cool store this variety up to the end of September each year.

Very little interest was displayed in the coloured varieties of grapes, although considerable quantities from Western Australia are shipped to Singapore each year. Some interest was shown in Canon Halls and I raised the question whether or not, in view of the limited supplies of green grapes on the market in January, a trial shipment of grapes not up to the required standard as to sweetness, would be warranted. This suggestion received favourable encouragement and on my return I arranged through the Export Grape Advisory Committee, for five cases with a Beaume reading of 8.2° instead of 9° prescribed in the Regulations to be sent on the M.V. "Gorgon" which left Fremantle on January, 21. I have since received a very favourable reply from the Australian Trade Commissioner to the effect that the grapes had arrived in very good condition and that their market value was in the region of $23 (£3) a case.

Unfortunately most of the grape shipments last year were sent non-refrigerated and I was told that waste was particularly high with such varieties as Red Prince, Red Emperor, and more particularly so with Flame Tokay. It is felt that the restrictions by regulation which are pending at this end, will do

much to reduce these losses. I received no complaints with regard to the Ohanez but it was emphasised that the fruit should be always sent in refrigerated chambers. I was able to explain that this was not always possible, but as soon as conditions improved it was the objective of shippers to send these grapes only under refrigerated conditions.

I raised the question of packing materials and inquired whether or not sawdust or granulated wood as used by the Americans, would be acceptable in place of the granulated cork; I was told in every instance that they preferred the granulated cork. It can be mentioned, however, that the American grapes packed in granulated wood arrived in a sound condition but when the berries were eaten fresh from the box, there was a strong turpentine taste associated with them.

I endeavoured to make some inquiries as to the extent of the market, but could not get very far. The nearest approach was 6,000 cases a month, which could perhaps be increased by 50 to 100 per cent.

During my stay over a period of approximately three weeks, I was able to see grapes from America and Holland and the following notes were made at the time:—

A. AMERICAN.

(a) *Fitraco Brand.*—Emperors.—On the label it was stated that the grapes were the product of the United States of America and specially packed for the Fidelity Trading Company incorporated in San Francisco, California. The minimum net weight of 32 lb. was shown on the label. The label was very attractive and only covered the lower third of the left hand side of the end of the box. The colours used consisted of two shades of blue combined with the colours of a portion of the U.S.A. Flag. Bunches of grapes in yellow, blue and red were also incorporated. The whole package was most attractive. These grapes were selling at between $25 (£3 10s. 0d.) to $26 (£3 13s. 0d.) a box, the condition was very good and the quality excellent. There was no breakdown associated with the berries, the packing material was granulated wood, the bunches were large and open and the berries large and well coloured. The boxes were made of pine, smoothly sawn and the overall measurements were 15 in. by 20in. by 8½ in. The tops, bottoms and sides were ⅜in. in thickness and the end boards ¾in. The boxes were wired with two wires each ½ in. from the ends. Grooves were cut out of the end boards to act as hand grips.

(b) *Blue Port*—Almerias.—This was another attractive label. These grapes were selling in the vicinity of $40 (£5 15s. 0d.) a box for a net minimum weight of 32 lb. Each box was stamped by the inspection services both Federal and State.

(c) *Port to Port*—Emperors.—This brand was also attractive. The fruit was in very good condition and was selling at $18 (£2 10s. 0d.) a box.

(d) *Pacific Prize*—Emperors.—The boxes were stamped "sawdust packed No. 1 grade Emperors".

(e) *Blue Flag*—Almerias.—These grapes were in very good condition, the bunches were open and the berries large and oval in shape, there was no wastage. They were being sold at $45 (£6 10s. 0d.) a box (during the first week in December) as against good quality Emperors selling at $24 (£3 10s. 0d.) a box.

(f) *Oh yes!—We grow the Best!—Californian Grapes*—Emperors.—The brand consisted of two bunches of grapes—one green and the other pink red attractively printed on small labels.

The American grapes, I understand, were shipped as refrigerated cargo from San Francisco to Hong Kong and in some instances, after fresh papers had been made out, were brought to Singapore direct. Other times the fruit was brought as deck cargo and I understand the journey was in some instances of five days duration; I saw a number of packages being unloaded on dealers' premises, each package consisted of six boxes wrapped securely in sea grass matting, sewn and then securely fastened with rope. I understand that no official obstacles are being raised against these importations despite the dollar restrictions.

I could not help noticing how well the labels remained on the American boxes. Very few instances were seen where they were either torn or loosened; several times I endeavoured to prize them off to bring back, but was only successful in two instances, viz; 'Blue Flag' and 'Oh Yes! We grow the best', both products of the Di Giorgio Fruit Corporation, San Francisco.

B. DUTCH GRAPES.

(a) *Famous Junior Brand.*—The varieties were "Blue Alicantes" and "Marocs" the product of hot houses. They were packed in crates three trays to a crate, simply held together by two tie wires. Each tray contained 9 lbs. of grapes without any packing material. Round each tray corrugated cardboard was used rising above the surface of the tray by approximately 3 in. The over-all measurements of the crate were 18 in. by 15½ in. by 12 in. Each tray was approximately 3½ in. wide and rested on four triangular up-rights held together by the two tie wires. The appearance of the grapes was good, particularly so as they still retained their bloom and were in a fresh condition, having arrived from Holland in refrigerated chambers. The flavour, however, was insipid and the colours, blue and black, are not popular in Singapore. I was informed that the c.i.f. cost of these grapes was $11.50 (£1 12s. 0d.) which included the commission fee of $1.50 (4s. 6d.). They were being sold at a price ranging from $9 (£1 7s. 0d.) to $11 (£1 13s. 0d.) a crate and the retail price in most instances $1 (3s.) per lb.

(b) *J. Brand.*—Towards the end of my stay in Singapore a further consignment of Dutch grapes arrived, packed very elaborately in crates similar to those mentioned previously. With these grapes, however, the tops of the trays were covered. The covering consisted of a border of coloured paper 3 in. to 4 in. wide made up of green and red stripes with little "j's" in red on the green stripes and in green on the red stripes; the remaining areas were covered with cellophane. Green paper was used to cover the sides of the two lower trays and blue and silver paper for the top tray. On the two lower trays the following information was printed in brown and cream lettering on the cellophane—"The Cream of the Crop," "Weight 9 lbs. net," and "Extra Fancy" at the respective left and right hand corners; in the middle the words "Aristocrat of Fruits" and "Quality De luxe," underneath the words, "Fully Mature Hot House Grapes," and in the lower right hand corner the name of the variety "Alicantes."

The top tray was even more gaily decorated and, in addition to the lettering, illustrations of two bunches of grapes were printed at each side of the cellophane covering. The colour of the paper used on the top was silver and the sides were in silver and blue. Triangular pieces of paper in silver and blue were superimposed on the paper on the sides, attractively printed to the effect that the fruit was the "Cream of the Crop" and a "Glass House Product," together with the symbol of the packer, large "J's."

Some crates of Black Marocs seen here were got up somewhat differently. Each tray was ornamented with blue paper, and cellophane cut to resemble bunches of grapes was superimposed on the paper in the middle of each side. The grapes were selling in the region of $3.50 (10s. 6d.) a tray but the dealer stated that there was very little demand as the variety was not popular owing, principally, to its colour and owing to the fact that American grapes were on the market.

It was obvious that the Dutch exporters had gone to a considerable amount of trouble in making their packs as attractive as possible. From hearsay I obtained the impression that the Dutch authorities were very anxious to build up financial reserves in Singapore.

Fig. 1.

Deck stowage on the M.V. Charon. The tarpaulins are drawn up during fine weather as illustrated in Figs. 3 and 4.

(Photo. by H. R. Powell.)

CITRUS FRUITS.

Approximately 3,458 bushels of Valencia oranges and 27 bushels of lemons were loaded as non-refrigerated cargo for Singapore on the M.V. "Charon" at Fremantle on the 5th November, 1947. They were stowed in two stacks of 800 cases, port and starboard respectively, on the forward No. 2 deck and 420 cases port and starboard respectively, on the No. 4 after deck; 1,018 cases of oranges were stowed in the forward lower 'tween cattle deck.

The fruit was supplied by 42 growers from the main citrus producing areas. The largest consignment was 279 cases from a Chittering grower and the smallest was nine cases, also from a Chittering grower; only 13 growers supplied 100 or more cases.

Through pressure of other work it was not possible to personally check the condition of the fruit prior to loading as had been arranged. However, some fruit was examined on board each day until the vessel arrived in Singapore. In addition, data was collected on humidities and temperatures at regular intervals each day and a report will be submitted on this aspect of the investigation. Unfortunately, owing to the wet weather experienced during the last few days prior to berthing a close inspection could not be made as had been arranged with the ship's officers. However, early in the morning of the day the "Charon" arrived in Singapore an examination was made of a number of cases in each stack and it was found that the fruit was generally in good condition, although there was some evidence of mould wastage in many cases; the lemons stowed in the lower tween cattle deck were in an obviously poor condition; there was little difference in condition between the various stacks whether deck or tween deck.

Some pulp temperatures were taken during the voyage and it was noticed that a steady increase occurred en route; the highest tween deck figure recorded was 83° degrees.

The vessel arrived on the morning of the 17th November, 1947. My stay extended to the 5th December, 1947; during this period, approximately three weeks, I was able to interview a large number of importers and Chinese dealers handling citrus fruits as well as other fruits and vegetables. A fairly good general picture of the methods of handling and marketing fruit was obtained and in this regard I was fortunate in having the assistance of the Australian Trade Commissioner (Mr. J. Payne) and Mr. R. Rew, representative of Wespak Ltd. Mr. Rew's Chinese assistant who acted as interpreter during many interviews with Chinese dealers made it possible to obtain information, which could not have been otherwise obtained. I was also able to follow up the discharge of the following cargoes of Valencia oranges: Approximately 3,500 cases from the Eastern States which arrived as ventilated non-refrigerated cargo on the M.V. "Obra" on the 19th November, and approximately 28,000 cases which arrived on the M.V. "Orestes" on the 29th November. The latter shipment was non-refrigerated but not ventilated in the proper sense of the word.

I understand the fruit ex the M.V. "Obra" came mostly from South Australia and the bulk of the cargo ex the M.V. "Orestes" came from South Australia, Victoria and New South Wales; 2,720 cases were loaded at Fremantle together with 75 cases of grapefruit and 58 cases of lemons.

The following remarks are based on the observations made on these two shipments which arrived from Australia during my stay and the information gained from interviews with primary importers and Chinese dealers, many of whom are importing direct.

1. WESTERN AUSTRALIAN ORANGES (VALENCIAS).

Condition.—The general condition of the oranges was very good. Wastage due to mould was light and it did not on the average exceed five per cent. on both vessels. This is mostly due to the fact that the journey from Fremantle is of short duration, normally between seven and 12 days. When the market was down owing to the large quantity of fruit discharged from the M.V. "Orestes," much of which was in a deteriorated condition, it was very noticeable that a lot of West Australian fruit was cool stored.

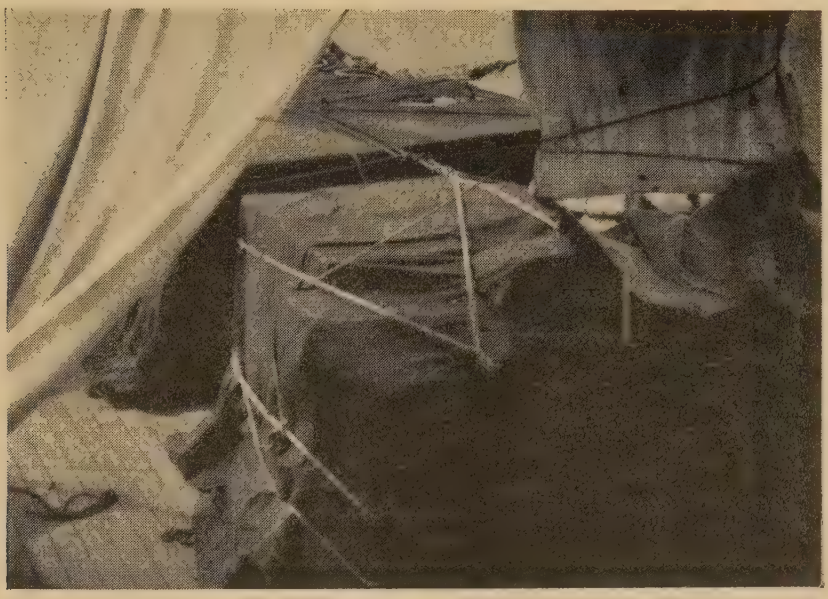


Fig. 2.

Deck stowage on the M.V. Charon. The fruit is well protected from damage by heavy rain. In the upper left and right hand corners appear portions of the canvas wind chute used to ventilate sheep and fruit in the lower and upper cattle decks.

(Photo. by H. R. Powell.)

Quality.—Quality was variable, some lines being very good and others just passing minimum export standards, blemishes were not an outstanding fault. The outstanding defects are discussed in the following section.

Defects noticed.—Oranges are grown in Western Australia over a very wide range of soil and climatic conditions and it is to be expected that there would be a considerable amount of variation in quality.

(a) *Colour.*—The Chinese prefer bright orange coloured fruits and consider yellow colour as an objectionable feature. In a number of instances, Valencias from Western Australia did not come up to this requirement; the fruit was pale in colour and thus prejudiced the buyer from the outset. It can be pointed out that most of the fruit seen from the other Australian States was of good colour and this was reflected in higher wholesale prices. Although fruit grown in the Chittering-Bindoon districts was on the average better coloured than fruit grown in the other districts, it was not always good.

(b) *Sweetness.*—Some Chinese dealers said all Australian oranges were sour and the comparison is made with the Chinese and Siamese mandarin oranges which are sold in Singapore in large quantities. These fruits are particularly sweet and are very popular. As far as fruit from the other Australian States are concerned, most of those interviewed said that the South Australian were the sweetest. This contention was tested out rather thoroughly and I came to the conclusion that, generally, West Australian fruit was not up to the South Australian standards. This would not be a serious disadvantage however, provided the oranges are brightly coloured.

(c) *Skin Texture.*—Coarseness of the skin was one of the major defects noted. Owing to the relatively light crop and the consequent incidence of large sizes, this defect was perhaps more exaggerated than what could be expected in a normal season. On the whole, oranges from the northern areas were more even textured than those from the other districts. In this regard however, some coarse fruit was seen from the Northern districts.

(d) *Shrinkage.*—During the voyage a considerable amount of shrinkage takes place but it was not so pronounced as with oranges from the Eastern States, due to the shorter voyage. The impression given to the buyer is that the cases are not properly packed.

(e) *Thrips.*—Some lines were marred by dark blemishes around the buttons of the fruit, caused by thrips. It was mostly associated with fruit from the Hills and Coastal districts.

(f) *General.*—Notwithstanding these defects, dealers stated that generally Western Australian fruit possesses excellent flavour and a high juice content. They pointed out, however, that although fruit is sold on appearance, there is a decided preference for well known brands. Unfortunately, owing to the relatively small quantities of fruit exported from this State and the large number of shippers handling consignments it is very difficult for even the better quality fruit to obtain recognition. For example such brands as the South Australian "Southoss," the New South Wales "Cock" or the Victorian "Gloria" are well known on this market.

Suggested Improvements.

(a) *Zonal Brands.*—Owing to the differing climatic and soil factors associated with citrus fruits in Western Australia, there is a great amount of variation in the quality of the fruit submitted for export. Inspection standards have been very considerably tightened and much has been done to reduce blemish tolerances. From the inspection point of view it is very difficult to reject fruit which fulfils the conditions laid down in the regulations but yet is not up to the quality required to build up an export market. It has been suggested that the fruit grown in the northern districts generally possesses more of the characteristics of good export quality. The best lines from these areas compared very well with the best lines from the other Australian States. It is thought that when the world wide financial restrictions are removed, Californian citrus fruits will tend to revert to their pre-war position on the Singapore market. Should this happen, there is a strong possibility that the demand for Australian fruit will decrease and it is likely that Western Australia will be seriously affected. It is felt that something should be done now to place at least a part of the export trade on a permanent basis.

One possible solution to the problem is given as follows:—

As the northern districts grow the fruit which it is thought has the best chance of meeting competition on this market, it is suggested that, provided the desired higher standard is reached, it be forwarded under a common zonal brand, irrespective through which exporter it is shipped. This is not to say that good quality fruit is not packed by growers in other districts but the contention is that average quality is lower in these districts. Fruit from other districts could be included under a similar scheme.

(b) *Packing Sheds.*—Most of the fruit seen was well packed but there was a marked lack of uniformity. This applies to sizing and quality equally to fruit from all districts. The institution of central packing sheds would do much to promote even export lines, and at the same time serve to divert unsuitable fruit to local market or factory use. Under the present system each grower when requested to supply an export order, packs what he considers to be his best line. Under this system it is difficult to achieve uniformity.

(c) *Presentation.*—The presentation of the better lines of Eastern States fruit was striking. The fruit was well packed of high quality, well coloured and properly sized. Attractive labels were used and the fruit was sold in such quantities that any particular brand could become well known.

Suggested improvements are as follows:

Wrapping Paper.—One Eastern States packing house was using orange coloured wrapping paper with very good effect and the dealer concerned expressed a preference for this colour. It is suggested that the adoption of this idea would be worth considering. It also might be mentioned that one particular line of Eastern States fruit was wrapped in green oiled wrapping paper commonly used for granny smiths. The dealer concerned was pleased because he thought the fruit was waxed.

Labels.—It was suggested earlier that zonal brands might assist in preserving an important export outlet for the State. The adoption of labels in conformity with this could have improved results. The Chinese are susceptible to appearances and good presentation is essential on this market. American grape exporters use striking designs on their labels and some of the leading Eastern States brands or labels were also very attractive. The use of colours is important, for instance, black and white are not popular with the Chinese as they are mourning colours, red and yellow are favoured in this order, but as yellow is a royal colour it should not be over-done. Green is the most popular colour.

When labels are used the greatest care should be exercised in ensuring that they are properly attached to the cases. There were instances of lines from the Eastern States which arrived in an unsightly condition owing to the labels becoming loose or badly torn. Labels on the American grape cases were so firmly attached that it was difficult to secure even one or two specimens to bring back.

(d) *Sweating.*—So far as the valencias were concerned, most of the fruit arrived in good condition, free from serious mould break-down. One of the defects, however, noticed was shrinkage which was considerable; this could be offset to some extent by sweating the fruit prior to packing. This would be even more important with navels packed during the wet months of June and July to minimise mould wastage.

(e) *Cases.*—All the Western Australian fruit was packed in Redwood dump cases and were all double wired and arrived in an undamaged condition. The quality of the cases seen was fairly good, but certainly not up to the level of the pre-war case. They are popular in Singapore and are handled very carefully by the Chinese on account of their resale value. When opening the cases they carefully prize off the boards and even keep the nails. There was no suggestion that the standard citrus box should be used.

(f) *Counts.*—I was informed that the counts most in demand range from 112's to 168's.

Fig. 3.
Deck stowage on the M.V. Charon. The coverings are tucked up during fine weather to provide ventilation.
(Photo. by H. R. Powell.)

Wholesale Prices.

A number of complaints was received concerning the higher cost of the fruit in Western Australia than in the Eastern States. I was informed that the difference was 6/-, 26/- as against 20/- a case. The c.i.f. cost is similar due to the lower freight rate from Fremantle.

The following figures were given of the cost covering the landing of Western Australian fruit in Singapore:

Cost f.o.b.	26/-		
Freight and Ins.	7/6		
	33/6	=	$11.50c.
Commission 5%	..	..	60c.
Landing Charges	..	..	30c.
Total landed cost	..	..	$12.40c.
			(£1 16s. 0d. approx.)

Two shillings and eleven pence is taken as the equivalent of the Malayan dollar, and threepence half-penny the equivalent of ten cents.

It was stated that dealers had to sell at $12.40c. (£1 16s. 0d.) a case to cover costs, and that during the previous two months sales had been below cost, ranging between $11. (£1 12s. 0d.) and $12. (1 15s. 0d.). Western Australian valencias ex the M.V. "Charon" were selling from $9. (£1 6s. 3d.) to $10 (£1 9s. 2d.) a case irrespective from which district they were grown. During the early part of my stay there were relatively small quantities of Australian fruit on the market—Eastern States valencias ex the previous "Burnside" were selling ex cool store at

$9 (£1 6s. 3d.) a case. These oranges were alleged to have arrived in a poor condition and that it was necessary for most of the fruit to be picked over. The cost of repacking was stated to be 30 cents, 10½d. a case.

Western Australian oranges ex the "Orestes" were in competition with large quantities of oranges from the other Australian States. Although the condition of the fruit was in most cases far superior, prices were generally lower than for Eastern Australian fruit, even with wastage as high as 20%. Prices ranged from $6.50c. (19/-) to $8. (£1 3s. 4d.) a case as against $8 (£1 3s. 4d.) to $10 (£1 9s. 2d.) for fair to good quality fruit from the other States. In a number of instances, however, wastey lines from the Eastern States were selling between $2.50c. (7s. 3d.) and $3 (8s. 9d.) a case. In one instance noted, West Australian oranges were sold by auction outside one dealer's premises for $6 (17s. 6d.) a case.

It was obvious that even the best quality oranges from Eastern Australia were not selling at profitable prices. This was due to a lack of confidence in the holding capacity of the fruit owing to its arrival, in a poor condition and the fact that the "Narbada" was expected to arrive in the near future with a large cargo of fruit from the Eastern States. The position was, of course, aggravated by the fact that large supplies of Chinese and Siamese mandarin oranges were on the market.

Fig. 4.
Deck stowage on the M.V. Charon, similar to Fig. 3.
(Photo. by H. R. Powell.)

2. WESTERN AUSTRALIAN LEMONS.

The condition of Western Australian lemons ex the M.V. "Charon" and M.V. "Orestes" was not good. Only small quantities were involved but they arrived in a badly deteriorated condition. Sixteen out of a line of twenty-seven cases which arrived in the M.V. "Charon" were picked over on the wharf and the pile of rotten fruit was left by the importer on the wharf. One case seen contained over 60% decomposed fruit caused by Blue Mould.

Another line seen ex the "Orestes" was in a similar condition. However, fruit seen in the markets and in the retail shop of the Singapore Cool Store Company in Orchard Road over a period of three weeks, appeared to hold their condition very well. Most looked their age but there was not very much evidence of subsequent wastage.

The prospects of selling considerable quantities of lemons on the Singapore market is remote; sales are mostly restricted to the relatively small European population. There is an abundance of various types of limes and they are preferred to lemons by the great majority of the population, including many Europeans.

3. WESTERN AUSTRALIAN GRAPE FRUIT.

Although I did not see the small consignment which arrived on the "Orestes", a quantity displayed for sale was noticed at the Retail Shop of the Singapore Cool Storage Company in Orchard Road, and at the Orchard Road Market. The retail price was 40 cents (1/2) and 30 cents (10½d.) each respectively and it was obvious that sales had been very slow. The fruit was old looking but was still in good condition. I was informed that grape-fruit are only used by the European population and thus have a very limited sale. It can also be mentioned that the older residents have become accustomed to Bali oranges, pomeloes, instead of grape-fruit.

4. WESTERN AUSTRALIAN NAVEL ORANGES.

The general impression obtained was that navel oranges from Western Australia had arrived in a much better condition last season than previously. The chief criticism was that they were not sweet enough. I was informed that the period of lowest orange supplies on this market is May to October, particularly May to early June. It is possible that comparatively small shipments of navel oranges at the end of May would bring profitable returns provided the fruit is well coloured despite any deficiency in sweetness.

5. EASTERN AUSTRALIAN ORANGES.

Whilst in Singapore I had an opportunity of seeing two shipments of Valencias from the Eastern States on the two vessels M.V. "Obra" and M.V. "Orestes", particulars taken at the time are as follows:—

"*Obra*".—Early in the morning of the 19th November, 1947, in company with the Australian Trade Commissioner, Mr. J. Payne, I saw the discharge of approximately 3,500 cases of Valencias from the M.V. "Obra." This fruit was carried as a ventilated non-refrigerated cargo in No. 5 'tween deck. Forced draught ventilation was used by means of a blower, utilising one of the ventilators, which had been converted for the purpose; it was claimed that the air was continuously forced through the entire hold. No particulars could be obtained as to the capacity of the blower.

The fruit was stowed on pieces of 3 x 3 timber, every third tier, ½in. battens were used every tier and a gully was provided fore and aft to increase the effect of the ventilation. According to the ship's officers the blower was used almost continuously until the vessel arrived in Singapore harbour.

From a superficial inspection of the fruit in the hold the oranges appeared to be in first class order and this was subsequently borne out when the fruit was seen on dealers' premises.

Matters concerning the ventilation of non-refrigerated fruit cargoes were discussed with Mr. Kirkwood Brown and the Calcutta representative, Mr. Easterbrook. I understand that Mr. Easterbrook came down specially to inspect this cargo. In a subsequent discussion with these gentlemen it was stated that the British India Shipping Company were prepared to equip their vessels with blower-type ventilation to meet the requirements of the Australian fruit trade.

One particular line of Valencias consisting of 100 cases was seen being repacked by women coolies at a dealer's premises to fill an army contract. Damage due to mould was slight being in the region of five per cent. Some individual fruits were badly blemished but most were bright and attractive. During the repacking operations no great care was taken and wrapped and unwrapped fruits were packed together, nor were the remnants of breakdown removed from sound fruit. Lines needing reconditioning are not always repacked into the same cases, and this was noticed in several instances.

Fig. 5.

Discharge of apples on Singapore wharf ex M.V. Orestes. Buyers were very keen to secure their supplies. It was amazing how lorries which appeared hopelessly traffic-jammed, managed to sort themselves out.

(Photo. by H. R. Powell.)

"*Orestes.*"—This vessel discharged approximately 28,000 cases of oranges, together with 24,000 cases of apples. Discharge was extended to over a week owing to heavy rain and the disinclination of importers to pick up their consignments. Two photographs taken within a short interval show clearly in one the rush to collect the apples as they were discharged and the other, stacks of oranges on the wharf waiting to be claimed.

In the hold the fruit was stacked on end, on boards placed close together on dunnage consisting of 3 x 3 timber. Each case was separated by battens ¼ inch wide, horizontally and vertically. The 'tween deck space was stacked from the roof to the floor and the only ventilation provided was the ship's air vents assisted by the removal of the hatch covers. It was difficult to see what improvement this method of stowage could give. It was stated that the hatch covers were removed during the voyage and that awnings were used when the weather was hot. Pulp temperatures taken in the hold exceeded 80°—the limit of the thermometer carried.

DEFECTS NOTICED.

On the whole the quality of the fruit seen was good despite the fact that much of it arrived in a deteriorated condition due to mould wastage. The following defects were noted:—

(a) *Cases.*—The cases used were white wood dumps and standard apple boxes. These containers did not stand up at all well to the rough handling meted out to them. This applies particularly to the white wood dumps of which large numbers were seen broken owing to the collapse of the jointed endboards. During the discharge the wharf was absolutely littered with orange peel and decayed fruit from the broken cases; photograph illustrates this very well. In addition, fruit was freely ullaged from sound bulged standard apple boxes. A barrel containing water was on the wharf nearby for the convenience of Coolies to cleanse the fruit they were eating.

In some instances the cases were discoloured and dirty and the stenciling was hard to read; in one instance seen the shipping brand was written in and showed up badly.

Many of the dealers interviewed stated that they would like the Eastern Australian exporters to standardise on the Australian apple box. Some complaints were received, however, that when these boxes were packed with a high bulge and through subsequent shrinkage, it appeared that they had been slackly packed. One dealer seriously stated that he was of the opinion that his boxes were one layer short.

(b) *Mould Break-down.*—In the hold it was apparent that many cases were badly affected with mould. In some instances it was almost complete and it was difficult to find a case that was unaffected.

Two photographs taken, one from the deck of the vessel of a loaded truck and the other of a stack of fruit on the wharf illustrate this very well.

On one dealer's premises a considerable number of cases were seen being picked over in an adjoining store-room; the amount of mould ranged from 30 per cent. to 50 per cent. in each case. During re-packing the fruit was cleaned and the cases wiped out; the contents in some cases were all mush. The dealer concerned estimated the cost of picking over at 30 cents (10½d.) a case using his own women coolies. After picking over the fruit was sold at around $8 (£1 3s. 4d.). Most of the fruit was of excellent quality and it certainly seemed a great pity that it could not be carried satisfactorily.

Very little can be done to prevent the incidence of mould wastage until improved methods of carrying non-refrigerated fruit cargoes are obtained. The arrival of the "Obra" was a striking illustration of what can be done. It was amazing how word got around that this cargo was a properly ventilated one; within a few days after discharge very few cases of this shipment were seen on dealers' premises.

(c) Labels.—There were some cases which, in addition to being dirty, were further marred by loose labels. These particular lines gave a very unfavourable impression of Australian fruit. It cannot be emphasised too emphatically that when labels are used the greatest care must be taken to ensure that they are properly stuck on to the cases. The labels used on the American grape cases were particularly good in this regard and considerable difficulty was encountered in removing even one or two to bring back as specimens.

(d) Packing.—In most instances the packing was of a high standard, but some individual lots were marred by the inclusion of badly blemished oranges. Some lines were outstanding and others, fortunately small in number, were poor.

The wrapping paper used included white sulphite, green oiled paper and orange tinted sulphite paper. Most importers seemed to prefer the orange coloured paper.

(e) *Wholesale Price.*—Wholesale prices for valencias ex the "Orestes" ranged from $7.50c. (£1 1s. 10d.) to $10. (£1 9s. 2d.) for good quality fruit in fair condition and was down as low as $2.50c. (7s. 3d.) for badly wasted fruit. Some of the better brands were selling at $8. (£1 3s. 4d.), even though the contents were damaged by mould to the extent of 20 per cent. It was difficult to get a range of prices for the "Obra" fruit as sales were made very quickly, the only figure obtained was $11. (£1 12s. 1d.). Most dealers complained that they were selling at a loss and were very apprehensive with regard to the pending arrival of a large cargo of fruit on the "Narbada." During this period, too, the market was very well supplied with Chinese and Siamese mandarin oranges.

(f) General.—The general impression obtained was that the better packs could successfully withstand foreign competition on this market. The difficulty, however, in competing with the fruit from overseas is that the fruit arrives in such a variable condition due to unsuitable sea transport. If shipments similar to that made on the "Obra" could be assured, it appears certain that this difficulty would be overcome.

6. SOUTH AFRICAN ORANGES.

On one dealer's premises I saw several standard citrus cases of South African valencias. The sizes were small, 324's but they were in good condition despite being in cool store in Singapore for approximately two months. There was no mould; only one fruit was seen that had a black dry discolouration around the button. There was a fair amount of superficial blemishes but they were slight and not unsightly.

They resembled very much the markings on some Western Australian fruit referred to by growers as silver russett, wind scurf, etc., but the markings were not so deep nor so well defined as seen in this State.

The fruit was selling around between $14 and $15 a case(£2 0s. 10d. to £2 3s. 9d.). The cases were attractive, made of white wood and packed with a

high bulge. Tops and bottoms were of very flimsy construction but the contents were undamaged. The containers were not labelled but were very neatly stencilled as follows:—

324—Valencia Reg. No. 1.
Zebedelia Citrus Estate,
Transvaal,
Empire Produce,
Union of South Africa.

This particular dealer stated that the South African fruit was of a better colour and better flavour than Australian fruit. Although it was of good quality I could not support his contention.

Fig. 6.
Discharge of oranges on Singapore wharf ex M.V. Orestes. Much of the fruit arrived in a bad condition and importers did not appear anxious to pick up their consignments.

(Photo. by H. R. Powell.)

7. CHINESE ORANGES.

(a) *Mandarins.*—During the period I was in Singapore there were large quantities of both Siamese and Chinese mandarin oranges on the market. These mandarins were large, ranging from three to four to the lb., light yellow in colour and with a very thin skin. The fruit itself is very juicy and sweet and is very popular with the Chinese. The season extends from the end of November to March and the periods of heaviest supply are January and February. The fruit is important with the Chinese community in connection with the festivals carried out during the New Year. I was informed that at this time it is customary for every member of a household when visiting another household to carry two oranges; with the exchange of New Year greetings the fruit is handed over and two others are received.

I was informed that bushel size cases with ½in. spacing between the boards are used. The net contents are approximately 40 lbs. and in some instances the fruit is wrapped in ordinary tissue paper. The journey from China takes up to 15 days and the mandarins are normally stowed as deck cargo. The landed cost is approximately $14 (£2 1s. 0d.) a case, and during the time I was in Singapore wholesale prices were in the region of $17.50 (£2 11s. 0d.). The fruit is usually sent on consignment and sold on a commission basis of five per cent.

(b) *Valencias.*—I saw several small lots of Chinese valencias which were very yellow in colour and immature looking. I was informed that the condition and quality improve greatly later on in the season. I understand that the landed cost ranges from $15 to $18 a picul. (£2 3s. 9d. to £2 12s. 6d. for 133 lbs. or approximately 13s. 2d. to 15s. 9d. for 40 lbs).

8. SIAMESE CITRUS FRUITS.

(a) *Mandarins.*—This fruit is also very popular with the Chinese. They are smaller in size than the Chinese mandarins and would go approximately six to the lb. Colour is greenish and the flesh is succulent and sweet and the skins are very thin. The fruit is imported from Bangkok in crates containing approximately 30 kattis of fruit (40 lbs.)

The wood used in making the crates is thick, approximately 1in.; and banana leaves were used as packing material. The crates were tied with rope and the overall dimensions were 24in. x 13 in. x 20in. I was informed that the season of greatest supplies extends from October to December and that the landed cost is $30 a picul (133 lbs.) (approximately £1 6s. 4d. for 40 lbs. of fruit.)

(b) *Pomeloes.*—Known also as the Bali orange, this large fruit arrives in wicker baskets or in bags. Each bag contains approximately 100 fruits, weighing approximately 150 kattis (200 lbs.). They are sent on a consignment basis and the dealer charges 5 per cent. commission. At the time of my visit they were selling at 25c. each (approximately 9d.) wholesale. They are very popular and to a large extent fulfil the uses of grape fruit with the non-European population and many older European residents.

9. MARKET CAPACITY.

Unfortunately my stay was too short to attempt to gauge the extent of the orange market for imported fruit, the only considered estimate obtained was 16,000 bushels a month. Under normal conditions large supplies of Californian and Palestinian oranges come on to the market and South Africa is extending her trade in this direction. Supplies have also been received from Portugese East Africa and it is possible that this trade will grow.

10. RETAIL MARKET PRICE.

The bulk of the retail trade is done in native markets by hawkers, and at roadside stalls. The quantity of fruit of all types displayed for sale is tremendous.

Retail prices were out of all proportion to wholesale prices. Sellers and retailers, of which there are only a few as we know them here, appear very hesitant to increase sales by reducing prices; they evidently prefer a high margin of profit and a smaller volume of sales. It is very obvious in the native markets that much of the fruit seen on display was old. During the time of the discharge of the "Orestes" wholesale prices were in the region of $6 (17s. 6d.) to $10 (£1 9s. 2d.) a case, but this was not reflected in lower retail prices.

The following two sets of figures taken during the first week of my arrival and the last week I was in Singapore—a period just over a fortnight—set out the retail prices at three representative centres, namely: the retail shop of the Singapore Cool Store Company in Orchard Road, the Orchard Road market, mainly patronised by Europeans, and wealthier Chinese, and the Native Market at Beech Road:—

———	Singapore Cool Storage.	Orchard Road.	Beech Road.
Pomeloes	65c. ea. (1s. 11d.)	65c. ea. . (1s. 11d.).	...
Siamese oranges	65c lb. (1s. 11d.)	60c. to 80c. lb. (1s. 9d. to 2s. 4d.)	...
Australian oranges	20c. eac. (7d.)	20c. ea. (7d.)	15c. ea. (5d.)
Australian oranges—140's W.A.	25c. ea. (9d.)	...	...
Limes, Siam (small and green—marble size)	70c. lb. (2s. 0½d.)	50c. lb. (1s. 5½d.)	20c. katti (7d.)
Lemons	15c. ea. (5d.)	...	15c. ea. (5d.)
Grape Fruit	40c. ea. (1s. 2d.)	30c. ea. (10½d.)	... ...

———	Singapore Cold Storage.	Orchard Road	Beech Road.
Pomeloes	65c. ea. (1s. 11d.)	...	...
Siamese oranges	65c. lb. (1s. 11d.)	60c. to 80c. lb. (1s. 9d. to 2s. 4d.)	70c. lb. (2s. 0½d.)
Oranges, Australian	15c. to 20c. ea (5d. to 7d.)	15c. to 20c. ea. (5d. to 7d.)	15c. to 25c. ea. (5d. to 9d.)
Oranges, Chinese	...	$1 20c. lb. (3s. 6d. or 10½d. ea.)	$1 10c. lb. (3s. 2½d.)
Oranges, South African (small)	...	10c. ea. (3½d.) 80c. lb. (2s. 4d.)	...
Limes	...	50c. lb. (1s. 5½d.)	...
Lemons (old)	15c. to 20c. ea. (5d. to 7d.)	20c. ea. (7d.)	15c. ea. (5d.)
Grapefruit (old)	40c. ea. (1s. 2d.)	30c. ea. (10½d.)	50c. lb. (1s. 5½d.)

It will be noticed that these retail prices are high and that there is little if any variation during the period.

The retail price of valencias (140's) was 9d. each at the retail shop of the Singapore Cold Storage Company; this is equivalent to £5 5s. a case. The wholesale price of this fruit ex M.V. "Charon" in all probability did not exceed $10 (£1 9s. 2d.).

Another point of interest is that the retail price of two lemons is equivalent to the cost of a pound of limes, which are more convenient to use in this climate and would go a great deal further. The price of Chinese mandarins reflects the greater demand for this type of orange.

Fig. 7.
A wharf scene during the discharge of oranges ex the M.V. Orestes. Coolies salvaging fruit from cases broken during discharging operations.
(Photo. by H. R. Powell.)

GENERAL.

Speaking generally, the market in Singapore during the time I was there was over supplied with fruit as far as profitable returns were concerned. Wholesale prices were depressed and apparently many dealers had suffered losses; retail prices were in the main unchanged, and were very high when compared to wholesale costs.

The arrival of the "Obra" illustrated how the market could be improved merely by the fact that word got around beforehand that the cargo was fully ventilated and likely to arrive in a sound condition. In the past there had been many out-turns similar to that experienced on the "Orestes."

It was very noticeable during the discharge of the "Orestes" that many different brands were used. Some are very well known, others not so much. Californian exporters use three brands, namely, "Sunkist," "Blue Goose" and "Pure Gold." In my opinion it would be advantageous if the number of brands used by Australian exporters could be reduced. A suggestion made for what it is worth is that an over-all State brand for similar quality fruit be used by all exporters in each State. This may not be possible but if it could be done I feel that present and future marketing difficulties would be improved.

The Singapore market is a very complex one and highly specialised, and perhaps the requirements are not so well known in Australia as they should be. Importers have, pre-war, been able to select their requirements from leading citrus producing countries. Owing to financial and transport difficulties since the liberation of Singapore, much of the fresh fruit previously imported from elsewhere, is being supplied by Australian exporters. Last year this trade was valued at £720,000.

It can be assumed that when present international trade barriers are removed, there will be a strong tendency for the Singapore trade to revert back to pre-war channels of supply. This can have a marked effect on the economy of the Australian Citrus Industry.

It is suggested that the retention of a large share of the present trade is dependent upon certain considerations. It is recognised, however, that neither citrus organisations nor exporters have had, up to the present, little if any control over the chief factors involved—namely sea transport and restrictions of quantities exported.

Some of the considerations concerned are as follows:—

(1) Improved sea transport facilities.
(2) Restriction of excess quantities of fruit being shipped; this is important because cool storage facilities in Singapore are restricted, and in any case excess quantities cause nervousness with buyers and consequent weakening of prices.
(3) Restriction of the number of brands used, in an effort to emulate the example of Californian exporters.
(4) Improved presentation with particular reference to—
    (a) cases and standardisation of the type to be used;
    (b) labels being firmly attached;
    (c) elimination of inferior packs.

In conclusion, it should be made clear that the Chinese dealer is an astute business man who knows what he wants. He has no particular love for any country and his driving force not unnaturally is the desire to make profits.

Fig. 8.

Non-refrigerated stowage unless properly ventilated can cause heavy losses to citrus cargoes owing to the development of blue mould. The contents of the cases depicted here were almost completely broken down.

(Photo. by H. R. Powell.)

TOMATOES.

Approximately 1,036 half bushel cases of tomatoes were loaded as deck cargo on the M.V. "Charon" for Singapore at Geraldton on the 6/11/47. They were stowed in four stacks of approximately 250 cases each, port and starboard, on numbers 2 and 4 decks respectively.

In company with Mr. G. Throssell, the district Agricultural Adviser, I examined a number of cases as they were being loaded from railway trucks and found that the condition of the fruit was good, being mainly green; in only a very few instances were any signs of ripening noticed.

A number of pulp temperatures were taken while the fruit was being loaded and they averaged approximately 72°. During the voyage pulp temperatures showed a steady increase and some recordings were as high as 88°.

At Mr. Crothers' request I took with me aboard ship a number of samples of tomatoes in varying stages of maturity wrapped in cellophane paper. These were placed in the cabin and were examined regularly throughout the voyage. Unfortunately the experiment proved unsuccessful. The moisture given off by the fruit condensed on the cellophane wrappings and within five days mould growths were well developed. At the end of 10 days most of the fruit was decomposed, with the exception of one package only, which for some unaccountable reason remained dry throughout the period; the colour of this lot was pinky-yellow on arrival at Singapore.

The fruit and tomatoes stowed on deck were watched during the voyage and data on temperatures and humidities was collected. Unfortunately, owing to wet weather experienced during the last few days prior to berthing a close inspection could not be made as had been arranged. However, early in the morning prior to berthing an examination was made of a number of boxes in each stack and it was found that the fruit was generally, in good condition although there was some slight shrivelling and a little mould was in evidence where the skins had been broken. Colour was mostly green and yellow and (g.y.).

The vessel arrived on the morning of the 17th November, 1947.

During my stay in Singapore which extended to the 5th December, a large number of Chinese dealers and importers handling tomatoes and other fruits and vegetables were interviewed and I was also able to follow up the discharge of 3,000 half bushel boxes ex the M.V. "Gorgon" which arrived on the 29th November, 1947. These tomatoes were in a sound condition but were more forward than the previous shipment; colour was mostly one third green, yellow and red respectively (g.y.r.).

During the course of my enquiries the following information was obtained.

1. BOXES.

The boxes used were generally satisfactory and I saw few instances of damage even when they were not wired. Most of the people interviewed stated that they did not think wiring was necessary. Some complaints were received that the wired boxes were packed too tightly and that the contents were often bruised. A lighter net weight and no bruises is preferred to a more well filled box containing bruised tomatoes.

2. STENCILLING.

On the whole the stencilling was only fair. in many instances the ink used was indistinct. This matter could be easily improved. Growers should realise the importance of making the package as attractive as possible. The adoption of suitably prepared labels would greatly assist in this direction. If labels are used then the brand and colours used would have to be carefully worked out as the Chinese have a curious preferment for certain colours and regard any pictorial brand as representative of the contents. A defect commonly met with when labels are used, is that they are often insecurely attached. This matter would have to receive close attention.

3. CRINKLE.

The type of fruit preferred are those which are round and smooth. Crinkled fruit is definitely disliked and it would not be wise to include fruit of this type in future shipments.

4. SIZE.

Most of the dealers interviewed required sizes ranging from 2 inch to 2¼ inch and preferred 2⅛ inch to 2¼ inch sizes. "Smalls" were disliked mainly I think on account of the price factor. Chinese dealers said that if "smalls" are forwarded they should be sent at a much lower price.

5. BLACK SPOT.

No complaints were received with regard to the disease "Black Spot." Apparently, owing to the climatic conditions in Singapore the disease does not progress any further during transport. Every care, however, should be taken to ensure that no diseased fruit is packed from the blemish angle.

6. SALES.

I understand that during 1946, F. Sadka handled Geraldton tomatoes on a consignment basis of five per cent. commission. Last year direct sales were made to dealers and importers. I understand that the actual landed costs per box are as follows:—

C.I.F. 20s. 6d.	$7.10c.	
Commission 5 per cent.	.40c.	
Landing charges to dealers stores	.15c.	
Making a total of	$7.65c.	(approximately £1 3s. 0d.)

Wholesale prices for tomatoes ex the M.V. "Charon" ranged from $7.50 (£1 2s. 6d.) to $8. (£1 4s. 0d.) a box. Supplies ex the M.V. "Gorgon" were riper on arrival and prices were as low as $3. (9s.) a box. I understand the average life of tomatoes arriving in good condition is limited to about 10 days. When the market is over supplied or the fruit is in a forward condition dealers have to quit, even at very low prices. Cool storage is not favoured.

I received the impression that the importers and dealers were not particularly pleased with the 1947 season. I was told that the first two shipments were profitable and that sales went up to $16. (£2 8s. 6d. a box but subsequent shipments were not profitable and prices received went down as low as $1. (3s.) to $2. (6s.) a box.

As could be expected complaints were made that f.o.b. prices at Geraldton were too high, it was said that c.i.f. prices should be around $8 (£1 4s. 0d.) early in the season and then, as the market declined, be reduced to $5 (15s.).

It was prophesied that future selling prices on this market would be in the vicinity of $5 (15s.) a box. The price factor is purely a question of supply and demand and can be regulated from this end until regular importations are made from the N.E.I.

It was stated that April, May and June were the worst months for profitable sales in Singapore and that prices improve from the end of June onwards.

7. QUANTITIES.

An endeavour was made to ascertain the market capacity, estimates varied from 500 boxes for each M.V. "Charon" and M.V. "Gorgon" to 3,000 boxes for each vessel. It appears fairly certain that if the market could be regulated present f.o.b. prices could be retained. A reasonable estimate would be 4,000 to 5,000 boxes a month using the two regular vessels. A previous M.V. "Asphalion" discharged approximately 8,000 boxes additional to normal quantities ex the "Charon" and "Gorgon" with serious results to dealers and importers and I was informed that losses aproximated to $6 (18s.) a box. As tomatoes can only be held for relatively short periods it seems obvious that such large shipments could do nothing else but upset the market.

8. DEFECTS NOTICED.

(a) *Deck Stowage.*—The matter of deck stowage was taken up with the shipping manager of Dalgety & Co. who was on board and the Captain of the M.V. "Charon" and it is confidently expected that much better facilities will be provvided in the near future. On the voyage to Singapore fruit stacked on the rails was subject to damage from both rain and seaspray.

(b) *Rats.*—Some damage was also caused to the fruit in the boxes en route through the activities of rats. Once the skin of the fruit is broken mould very quickly commences and the value of the contents of the boxes is lowered.

(c) *Climbing cut-worm.*—A few climbing cut-worm larvae were noticed during the voyage to Singapore but they were much more numerous on the fruit ex the M.V. "Gorgon." They did a considerable amount of damage by breaking the skins of a large number of fruits which subsequently became affected with mould and decomposed. This matter should be very closely watched at Geraldton, particularly with the shipments made towards the end of October and during November.

(d) *Branding.*—A number of instances were noticed where the boxes were incorrectly marked, that is to say, the 2 inches were marked 2¼ inches and so on. In any case large fruit is not popular on this market and care should be taken always to correctly mark the sizes of the fruit on the boxes.

9. HIGHLANDS TOMATOES.

Considerable quantities of tomatoes are grown in the Cameron Highlands approximately 500 miles by road from Singapore, the quality of the fruit seen was in many cases very good, but in some instances appearance was marred by deposits of what appeared to be Bordeaux mixture. I was informed that this

fruit comes on to the market in quantities during the period early August to the end of November and that the average prices are around $8 (£1 4s. 0d.) a half bushel. The fruit seen in the markets was dark green in colour, round and smooth and mostly around 2½ inches in size; when ripe it is very red.

Fig. 9.
A tremendous quantity of fruit is displayed for sale in Singapore. In addition to native markets thousands of hawkers set up business at street corners outside city buildings, etc. The illustration depicts a typical scene.
(Photo. by H. R. Powell.)

10. CHINESE TOMATOES.

In some of the dealers' premises large stocks of Chinese tomatoes were seen. They were packed in baskets containing approximately 150 lbs. net. Sizes ranged from 1½ inches to 2¼ inches. Colour of the fruit was green and yellow in equal proportions and there was a lot of superficial blemish caused by the fruit rubbing against each other due to movement in the containers. Both smooth and crinkle types were included and although they were sound they were inferior to both Geraldton and Highland fruit. I was informed that the wholesale prices ranged from $18 (£2 14s. 0d.) to $20 (£3 0s. 0d.) a picul (133 lbs.).

At the native market in Beech Road tomatoes as small as ½ inch in diameter were seen. I was informed that the supplies from China commence to arrive during November and extended to the middle of June and that the voyage to Singapore is six or seven days.

11. RETAIL MARKET PRICES.

A number of visits were made to a representative retail shop, the Singapore Cool Storage retail shop in Orchard Road; a market mainly patronised by Europeans in Orchard Road and a native market in Beech Road for the purpose of checking up on retail prices. These were as follows:—

	Singapore Cool Storage.	Orchard Road.	Beech Road.
Tomatoes—Australian ...	60c. lb. (1s. 9½d.)	60c. to 80c. lb. (1s. 9½d. to 2s. 4½d.)	50c. lb. (1s.6d.)
Australian (ripe) ...	...	50c. lb. (1s. 6d.)	...
Highland (large 2½in. and very ripe)	...	80c. lb. (2s. 4½d.)	80c. lb. (2s. 4½d.)
Chinese	...	...	60c. katti. (1s. 4d.
Chinese, old (2in. to 2½in. size)	...	...	40c. katti (11d.)

It is obvious from these prices that locally grown fruit from the Highlands are more than holding their own against imported tomatoes and the statement sometimes made that the locally grown tomatoes are inferior, is untrue.

GENERAL.

Geraldton tomatoes are popular in Singapore as far as quality is concerned. Some improvements can be made as indicated earlier and this applies particularly to size, type of fruit and freedom from insect attack etc. The market is restricted, however, as far as present f.o.b. price levels are concerned. If quantities greater than 6,000 boxes are sent each month then it is obvious that the market will be weakened, resulting ultimately in lower prices to growers. If, on the other hand, sales can be regulated, I think present prices can be maintained provided that the size of the fruit offered ranges from 2 inches to 2¼ inches. It appears that some reduction in f.o.b. prices may be necessary as far as "smalls" are concerned.

Close attention should also be paid to the condition of the fruit prior to shipment and no fruit showing signs of ripening or infested with climbing cut-worm should be permitted shipment.

It is interesting to point out that the Chinese do not usually eat tomatoes raw but consume them steamed.

POTATOES.

Although I had no prior intention of making any inquiries regarding potatoes, I had no option; so many complaints were made concerning the size of Australian potatoes in general, and those from Western Australia in particular, that I compiled the following notes in the hope that they could at least be brought under the notice of those interested.

The following information was obtained from a large number of dealers and importers in the course of the inquiries being made on behalf of fruits and vegetables. All those I interviewed were unanimous that the quality of Western Australian potatoes was good and they were far too large for the particular trade requirements of Singapore.

I saw some tubers which weighed as much as 1¼ lbs. each and I was told that there had been instances when they exceeded 2 lbs. These large sizes are disliked for the reason that the main consumers, Chinese and Indians, do not eat mashed or baked potatoes, but like them small for curries and festivals. Large potatoes when cut up for use in curries lose their shape and become mashed during the course of stirring and cooking operations.

I understand that the Indians prefer wherever possible to obtain whole portions of fruits and vegetables and they dislike eating pieces. Another important factor is that when potatoes are retailed, often in small quantities in native markets, both the seller and the buyer dislike receiving and retaining respectively portions of tubers, which after cutting become quickly discoloured.

At the moment there is no general objection to dirt but with competition this matter may easily arise. The Chinese are fastidious and they prefer only brown soil discolouration on the tubers; they do not like black residues, and this applies particularly to importations from Victoria; apparently the black colour is related in their minds to death and decay.

From inquiries made it appears that the wanted weights are those between 2 to 4 ounces, although some dealers preferred 2 ounces. There is a market for the larger tubers with ships' chandlers and the relatively small European population, but it is a limited one.

Another complaint encountered was the extreme range of net weights forwarded from Eastern Australia particularly. It was pointed out that they range up to 135 lbs.; when sales are made by auction it is on the basis of a net weight of 112 lbs. and consequently importers buying supplies at so much per ton tend to lose more on the transaction. It would be wise for net weights of 112 lbs. to be carefully checked when the crates are being filled.

The following interesting information was obtained from a large importer:—

1. He said potatoes from Egypt and Australia are available at the same time and expressed the desire to obtain supplies from Australia as he disliked the methods adopted by some Egyptian traders.

2. He gave the following information as to importation into Singapore for the pre-war year 1939, which totalled 15,000 tons (approximately).

	Tons
Italy	181
South Africa	101
Other African countries	453
Canada	267
India	343
Burma	1,312
Other British Asian countries	1,660
Australia	154
France	132
Holland	2,583
Egypt	1,088
U.S.A.	9
China	1,556
Indo China	5
Japan	3,888
Java	1,515
Sumatra	18
Siam	20
Other Asian countries	10
	15,295

3. He estimated the minimum present day consumption in Singapore was greater than pre-war and was in the region of 20,000 tons a year, due to the shortage of rice and the fact that more money was in circulation.

4. I was told that the Egyptian potatoes arrived in large wicker baskets. The tubers are small and are from brown soil districts.

5. He said that the Australian potatoes were far too large and too dirty. If Australian exporters cannot supply requirements then supplies will be obtained elsewhere.

6. It is the custom of dealers to auction supplies in excess of their requirements and it is important to remember that a 120 lb. crate can be sold at the same price as a 112 lb. crate.

7. The net weights of Dutch crates are always the same, being in the region of 50 kilos or 110 lbs.

8. The Singapore c.i.f. price for Western Australian potatoes is around £32 per ton, that is £24 a ton f.o.b. Fremantle.

At the present time I was told that the cost of importing supplies from Egypt was in the region of £36 per ton c.i.f. The Egyptians met the requirements with regard to size and cleanliness, but consignments are often spoilt by a high per cent. of spoilage, which on occasions reaches 50 per cent.

9. The average voyage from Port Said is 14 days but is longer if the vessels call in at Bombay.

10. The Singapore import quota for Canadian potatoes at the present time is 580 tons. These potatoes are packed in 100 lb sacks, the c.i.f. price being 20s. 6d. a sack, which is around £26 per ton.

11. The freight and insurance on Western Australian potatoes ranges from £6 10s. to £7 a ton—the price f.o.b. Fremantle is in the region of £24 a ton.

12. There is a large demand for small potatoes. He estimated that the supplies needed by ships' chandlers, Europeans, etc., would be only 10 per cent. of the total quantity imported.

13. He said this season the whole South African crop has been bought by the United Kingdom Government. Owing to this fact there will be a greater demand for Australian potatoes. It will only be temporary, however, unless requirements with regard to size and cleanliness are met.

Following the arrival of the "Orestes" and the "Gorgon" almost simultaneously on the 17th November, 1947, visits were made to a number of dealers and to the retail markets for the purpose of checking up on quality, condition and price.

Approximately 9,000 crates of potatoes were unloaded from the two vessels; the Victorian potatoes ex the "Orestes" were only in a fair condition as many of the tubers had shot and were soft. Many of these crates were seen with long shoots trailing out ranging from eight inches to one foot in length.

Inquiries revealed a very poor demand and as far as W.A. was concerned the stated reason was that they were too large and too dirty.

Sales were from $12, (approximately 36s.) to $14, (approximately 42s.) a crate, compared with $16 (approximately 48s.) per crate, the price operating the previous week.

I was told that at the time of the discharge, inferior Dutch seed potatoes were selling at $14 (approximately 42s.) per bag. The price of Victorian potatoes ranged from $10 (approximately 30s.) to $11 (approximately 33s.) a crate.

Visits made to the retail shop of the Singapore Cold Storage in Orchard Road and the markets in Orchard Road and Beech Road revealed the following retail prices:—

	Singapore Cold Storage.	Orchard Road Market.	Beech Road.
Potatoes—W.A. large ...	25c. lb. (9d.)	30c. lb. (11d.)	15c. lb. (5½d.)
Dutch small	35c. lb. (1s.0½d.)	30c. lb. (11d.)	26c. lb. (9d.)
Cameron Highlands (small, fresh but scabby)	...	60c. lb. (1s. 9½d.)	...

It is interesting to note that scabby but small and fresh potatoes from the Cameron Highlands were retailed at a price round 1s. 9½d. a lb. as against a price ranging from 5½d. to 9d. a lb. for good quality tubers from W.A. The reason of course was that the size of the locally grown potatoes met requirements. These potatoes were more or less the size of marbles, immature, but were suitable for cooking in curries.

During the course of my stay I had the opportunity of seeing potatoes from Holland and from Canada at the Orchard Road Retail market. The following notes were made at the time.

1. *Dutch.*—These potatoes were washed, and adhering to them were particles of a fine light grey soil. I was told that the Dutch authorities ban the export of potatoes from sandy soils. They were all graded and ranged between two and three ounces in size. At that time, the middle of November, the retail price was 40 cents a katti or 11d. per lb. The crates were rectangular in shape and were constructed of white wood. The dimensions were as follows:—23½ inches long, 16½ inches deep, and 14 inches wide. There is a central division and the net contents average 110 lbs.

2. *Canadian.*—These potatoes were approximately twice the size of the Dutch, and they were clean and well graded. The tubers were roundish and somewhat flattened in shape and were very attractive in appearance.

Crates.—Full details of crates from Holland and Belgium is as follows:—

(a) *Dutch.*—White wood rectangular, length 23½ inches, depth 16½ inches, width 14 inches, ¼ inch timber construction. Centre support full width and depth ½ inch timber divides crate in two. ¾ inch timber cleat full depth of crate. Wired both ends. 1 cwt. net.

(b) *Belgium.*—Rectangular white wood, length 23 inches, depth 14½ inches, width 18 inches, and ⅜ inch timber. Centre support skeleton only, does not actually divide the crate. Two different size timbers used. Support measurements 1¾ inches x ⅜ inches and 3¼ inches x ½ inch. Support traverses all four sides; there is also a central upright support, but no supporting cleats. Crate strapped at each end ½ inch steel strapping. 1 cwt net.

GENERAL.

From inquiries made, it appears that a very large market for potatoes exists in Malaya, estimated at approximately 20,000 tons a year. In the pre-war 1939 import statistics given earlier imports from Australia were in the region of 154 tons; I was told that if the size could be reduced to meet requirements, then it was very probable that the large quantities previously obtained from Egypt would be placed in the hands of Australian exporters. During 1939 imports from Egypt were in the region of 1,088 tons.

As far as cleanliness is concerned, that is not so important at the present time, but there is no doubt that it will arise later on. A very great distaste is shown to the black soil residue as mentioned earlier.

As far as the condition on arrival, W.A. potatoes were good but there was some mould in evidence where the tubers had been damaged either by forking or by rough handling during packing and transport operations.

KIKUYU GRASS.

M. Cullity, Superintendent of Dairying.

KIKUYU GRASS (*Pennisetum clandestinum Pilga*) has been established on farms in Western Australia for approximately 30 years, having originally been an introduction from South Africa.

For a long period no real effort was made by farmers to establish large areas. The grass was considered as a curiosity, although favourable comments on its growth and palatability were frequent. Farmers were loth to expend much labour on the planting of the runners, in view of the many failures which occurred—due principally to a lack of appreciation of the fact that stock, if permitted to graze too soon after planting would pull the young plants out of the ground.

However, with the passage of time, the grass has become very prominent on a number of properties, largely through the persistent efforts of the owners and partly due to the natural spread of the grass by its runners.

Until recently there was no record of the grass seeding under West Australian conditions and therefore all expansion of areas was as described above. In recent years, however, reports have been received, particularly from the more southerly portions of the State, Manjimup, Margaret River, Northcliffe, Denmark and Torbay, that the grass is being spread by seed. A number of seedlings have been found usually associated with cow droppings. It is possible, therefore, that the rate of spread will become much more rapid with the further acclimatisation of the grass.

A small sample of seed was obtained from the Waite Institute in South Australia and this has germinated satisfactorily on two Government-owned properties, the Denmark Research Station, Denmark, and Sabina Vale, Busselton. It is hoped that these will provide nursery plots from which seed will be collected for distribution.

As the grass spreads by extending runners, both above and beneath the surface, its expansion is very rapid under good conditions. It likes friable soils and summer moisture. In these conditions it will give nearly twelve months of good grazing. It gives least growth during the winter months, particularly where frosts are experienced, as these adversely affect growth and give the grass a yellowish colour.

While it will grow vigorously in summer moist conditions, it will survive also in very dry places. In these conditions very little green growth is obtained during the summer. It responds very rapidly to the first rains and gives a reasonable amount of grazing before the annual pasture species have germinated. In this way it is effective in extending the grazing period in the dairying districts, being earlier in the autumn and later at the end of spring.

Subterranean clover and Kikuyu grass growing at Harvey under irrigation.
(Photo by G. N. Lowe.)

Kikuyu frequently is found growing without association with other species, but this should not be taken as proving that it will not grow in association with clovers. Failure to graze fairly closely will allow a dense spongy mass to be produced which has the effect of smothering clover. Where it is prevented from making rank growth it will be found that subterranean clover will grow freely with it. The need for avoiding rank growth is greatest in the autumn.

The grass responds to organic manure, such as cattle droppings and to artificial nitrogenous fertiliser. A basal dressing of one bag of superphosphate per acre each year should also be supplied.

It has been found to be very palatable to all classes of stock. Its feed value is high and therefore it is a very satisfactory species for milking cows. Owing to the density of growth, its carrying capacity is high, not only measured in terms of the number of stock which may be carried at any one time, but also in relation to the length of the period in each year over which it will provide grazing.

Kikuyu grass may become a nuisance if allowed to invade gardens or swamps needed for vegetable cultivation. However, regular attention will prevent its doing damage. A frequently difficulty experienced by the farmer is in handling the spongy mass which results when the grass is allowed to become rank. Before a satisfactory grazing condition can be regained, it is necessary to remove the mass of above-surface runners and dead stalks. This can be done by crowding a large number of stock, preferably dry stock, on to the area so that it is eaten to the ground. Alternatively, the area may be burned before the first rains.

The grass is usually established by planting in furrows three feet to four feet apart and from 1½ feet to four feet apart in the rows. The cuttings should be six inches to nine inches long and be planted about two-thirds beneath the ground. Although many farmers have been successful when the runners have been completely covered, this method is frequently unsatisfactory owing to the likelihood of the cuttings rotting. The furrows may be opened up across the paddock without plowing the whole area, or the grass may be dibbled in a furrow prepared in a crop such as oats, barley or Sudan grass. Many methods are in use, in some of which attempts are made to reduce the labour involved. Some of these will be mentioned in the farmers' notes which follow. Special reference is made to the section describing Mr. J. H. Doley's success.

In many areas, spring planting has proved the most successful, but provided autumn planting is early and the ground is warm, successful establishment can be achieved.

THE GRASS SHOULD NOT BE GRAZED TOO SOON AFTER PLANTING.

If it can be arranged, the paddock, after planting, should be left closed for a full year. For example—if it is dibbled in on a ploughed surface, the paddock should be closed and not opened until the commencement of the following winter. If it is sown under an oat crop, the oats may be grazed lightly and then the area closed for hay and the paddock not grazed during the following summer.

Another successful method has been to dibble in the roots with a crop of maize. No grazing, of course, should occur until the green crop has been removed, by which time the grass has become firmly established. In one such case additional success was achieved by immediately re-ploughing the area, thus cutting up and scattering the plants, and then sowing to oats. In this way the paddock was withheld from grazing for a full twelve months.

Even while the value of kikuyu grass is so great, there is still some reluctance on the part of many farmers to endeavour to expand the areas on their properties, and therefore the opportunity was taken of procuring from a number of successful growers a record of their experience and comments. These are published for the information and encouragement of other farmers.

C. Butler, Walpole.

"The kikuyu was established when I came here, but it has spread considerably since, and the more it spreads, the better I like it. This last season, with rain right through the summer, it has been of immense value for the stock, the cows would come home early before milking time to graze on it. I can safely say that the kikuyu adds considerable value to this property. I have no difficulty in keeping it out of the garden. By having a pad or drain around, all one has to do to see

that it doesn't get across is to pull up the runners crossing it, say, about once a month. The whole mob of cows are on it almost every night and graze on it, we have no other paddocks with kikuyu except patches, but if we shut it off for hay very late, it still gives a very heavy sward of hay, so heavy that it takes two good horses to pull the mower. The hay has a bleak colour, but it is all leaves, no stalk, which is another very valuable thing about it. I want to mention that no matter how tall, the stock will always like it. I have put cows in pig paddocks where besides plenty of white clover, the kikuyu was more than one foot high, yet they took to the kikuyu, if paspalum they wouldn't take it. Every place, in my opinion, should have at least three or four acres around the sheds, specially where the cows camp overnight and the horses can be kept handy whenever wanted. I think this small area would keep a couple of horses and give a green bite right through the year during the night for the cows, no matter how many, besides good grazing for pigs."

Roots being torn up by a rigid tyne cultivator.

W. J. Rooney, Glen Warren, Manjimup.

"We burnt the front paddock just prior to the rain and this paddock, although carrying three sheep to the acre, has beaten the oats in growth.

"We have disked 25 acres of new clearing on the Nornalup Road and are at present sowing kikuyu roots there. We plough a patch and I cut it up with the discs and then fork it on to the truck, and from the truck to the field. We have about 100 acres under kikuyu and I would like to see about 200 acres more. The way it reacts to rain after burning is a revelation.

"We used to lose considerable stock through dry bible or starvation before the kikuyu became established, but we haven't lost any since.

"A neighbour planted 10 acres with roots and he told me that more or as much grass came up from seed as from the roots. In any case, I saw the paddock last week and it was very well established. They cut up a patch of grass with a rotary hoe, sowed it on cultivated ground, cultivated it again, and then rolled the paddock. One thing I have noticed, and that is that you will not find kikuyu growing from seed in any of the bush paddocks or at any distance from where it has been established. So that if it is to grow from seed it would probably be only under real good conditions.

"We usually plant out the roots and when these have established themselves and the paddock has been cultivated a couple of times, the kikuyu takes charge, but not completely, as where it is well grazed the clovers still do well. There is quite a good show of droophead and sub. clover in the front paddock.

"We are all quite enthusiastic about kikuyu until its gets into the garden, and then the more you try to kill it the better it grows. I don't know how it could be renovated except by burning. The tandem discs make very little impression. A fairly heavy caterpillar tractor could not pull a set of tynes through even the small patches."

Clump of roots after treatment by rigid tyne cultivator.

J. A. Nilsson, Margaret River.

"Our first plot (four acres) was established way back in 1926. Method of planting was, land ploughed with a single-furrow disc plough, roots dropped in every third furrow, one foot apart. The method we used now is, go over the land once with a tandem scalloped disc harrow, cut the roots in, say, four or five inch lengths, and broadcast them. The area is disced again and then a stroke of the roller is given.

"You ask for method of control: We don't want to control it—let it go. The sooner it covers the whole farm, the better off we will be. Renovation, yes, that is important. We run the 'Sunprong Renovator' over it, make it go in as far as it will, the deeper the cultivation the better. If the paddock has been neglected, the only way is to put a plough over it. A fire seems to do a lot of good, but I don't believe in fires over the pastures.

"Carrying Capacity.—Our opinion is, we have no grass as yet that can stand up to kikuyu. If any other grass had had the same abuse as kikuyu, why, it would have disappeared never to return.

"Earlier I recommended ploughing an old stand. We do this in autumn and sow Wimmera rye and sub. clover to give us winter and spring feed. After that, the kikuyu comes away better than ever. The other renovating is done in July.

"I like kikuyu for the following reasons:—It gives the stock a green bite almost all the year round. On the hills, it dries off to a certain extent, but should we have summer showers, it responds very quickly. Once the early autumn rains appear, why, man, it simply bolts away, and that's why I consider it so valuable: it beats Perennial Rye hollow. I admit that frost plays havoc with it, but when that occurs, the clover and Wimmera Rye are at their best, and the kikuyu comes again. It is advisable to avoid long, rank growth.

"I honestly believe that kikuyu is the best grass we have in our districts.

"We usually put in 60 or 70 acres of oats for early feed. When we get more areas of kikuyu, I am sure that will not be necessary."

A. Rocchi, Karridale.

"I have 40 acres of kikuyu and have a lot to say in favour of it.

"It covered a very small area when I took over about 12 years ago, and had apparently been recently planted.

"I tried planting an area of new land which had been rung and recleared by myself, but it proved a failure.

"I then planted it in the old clover paddocks on mixed land (some white sheoak sand with coffee rock about three feet below), also in good grey heavy loam with good subsoil, and in fairly heavy clayey soils.

"The method of planting was as follows:—Single furrows about three inches deep and 12 feet apart were ploughed with a mouldboard the full length of the paddocks, the kikuyu runners (about 10 inches long) were placed in the furrows end to end and then the soil was raked back into the furrows and covered the runners completely.

"All of the paddocks were treated with super. and ammonia three to one at a bag per acre for three years. Since then, super., and super. and copper.

"All of the paddocks were good clover paddocks, mostly mid-season sub. with some droophead and a little cluster.

"It took four years for the kikuyu to cover the ground completely, but of course if the original furrows were ploughed about three or four feet apart, it is probable that the kikuyu would have covered the land in the second season.

"I noted that the kikuyu planted in June and July hardly shifted until about mid-September and did no better than kikuyu planted in August and early September.

"Kikuyu on all soils seemed to grow equally well, but stayed greener at the height and end of summer in the heavier soils, but yellowed considerably in the sand.

"In March, 1945, and March, 1946, we burned the kikuyu and followed up with a Massey scalloped disc cultivator, heavy, drawn by a Massey tractor. This did fairly good work, but not good enough.

"My opinion is that it needs an implement like the "Sunprong" to give the roots a proper tearing up at least once in two years.

"Sub. clover seems to grow with it very well, excepting in the fairly wet swampy patches, when the sub. cuts out.

"However, a sowing of burr once in two years seems to keep the sub. there.

"I am all in favour of kikuyu. I dry off all my cows in January and they commence calving about mid-April and are all in within a month. The kikuyu, though only semi-green from mid-January to end of March, enables the cows to maintain their condition easily until calving time, with the result that they are at their top almost immediately, and if we get fairly early rains, late March to mid-April, there is an abundance of young green kikuyu within two or three weeks, whereas everything else—oats and other pastures—are much slower in providing early feed.

"In my opinion, kikuyu's only failing is that it is susceptible to heavy frosts, which yellow it off considerably, but by the time we have heavy frosts, the kikuyu has fulfilled its main purpose, and has provided an abundance of feed when most needed. My figures for average production per cow based on the butterfat delivered to factory, plus whole milk for calves and milk and butter for house, since 1940, are as follows, and I think that kikuyu is one of the main contributors.

Year	1940	235 lbs.
„	1941	282 „
„	1942	246 „
„	1943	300 „
„	1944	233 „
„	1945	328 „
„	1946	272 „

"These figures are absolutely correct, as per my year book."

J. J. Daly, Bornholm.

"The kikuyu grass on my property has been planted some ten years. I have made a practice of planting it on my light land where previously clover pastures deteriorated and went quickly to silvergrass and finally to sand and, naturally, I was very dissatisfied. There was also a crop of bracken on these paddocks. The bracken was difficult to kill owing to the deep nature of the sand. So I decided to have a shot at kikuyu. I ran out furrows with the plough, ploughing to a depth of three inches, every three feet apart, then I grubbed up a large heap of kikuyu roots, chopping up the roots with an axe on the block of wood, chopping the roots up to six inches in length, which I planted along the ploughed furrows one foot apart, then dragging an old tyre of a cart over the furrows to fill in dirt again. The whole of the land was not ploughed, as there was a little clover scattered about which I never interfered with. My cattle could get a bit of grazing while the kikuyu was establishing itself.

"Kikuyu grass is very easily established on paddocks where clovers have been growing on same. I have also planted it on new land, but found it slow to establish without farm yard manures.

"Anyone trying to establish kikuyu grass should remember it thrives well on farm yard manure. My advice is to make night paddocks for the cattle and harrow the droppings, then the kikuyu will be at its best. Super. also, one bag per acre; but I attribute the greatest success to cow manure.

"Kikuyu grass likes a natural drained soil. It has built my light land to the same carrying capacity as my best soil, it is turning the poor land into a highly profitable venture.

"I have seen around my district rich paddocks of kikuyu growing on land that was one time termed valueless country, only good for bracken. When the kikuyu gets well established, it kills the bracken out.

"Kikuyu is a great boon, as it provides grazing practically for nine months of the year, if summer rains are about. Also it is most useful in the autumn. It comes away well and provides a good bite for stock while the annual pasture is growing.

Roots being freed from soil by pasture harrows.

"I also would like to stress the fact that animal droppings will appear heaviest on kikuyu paddocks and far in excess of other paddocks. This indicates that more grazing has been available. The pasture harrows are needed to spread the manure evenly over the paddocks.

"Some farmers talk of burning kikuyu in late summer, as it shoots up nice and green. I don't favour burning, any rotten dry leaves on the bottom, I contend, should rot back to the soil, not be burnt. Kikuyu is a lover of organic manure.

"My estimation of kikuyu grass, where it can be established, is that it is a highly profitable venture, and I would advocate at least 25 per cent. of each farm area be planted.

"Some farmers, before they plant, talk about putting roots through a chaff-cutter: that is a little miserly. Don't spare the roots—your time will be well repaid."

S. A. Brenton, Parryville, Denmark.

"Kikuyu was put on my peat swamp, which would not stand any man's weight. Therefore it was decided to plant it in kikuyu, water couch, Yorkshire fog, with the idea of forming a solid mat on the surface which would carry stock, and eventually consolidate the swamp. As the peat was so soft we had to turn it over by hand with a goose-necked hoe. Then the job was to dibble in the kikuyu, using pieces nine inches long. These were planted in line three feet apart each way. Then I took a bucket of super. I dropped a handful at each pace, three feet apart, and pushed the root and manure under the surface, making sure it was in the moist soil, well underneath, and tapped it down firmly, as the peat was very light.

Clump of roots after treatment by pasture harrows.

"But let me tell you that I do not advocate kikuyu in a first-class swamp where a farmer can put in potatoes, maize, or any root crops, as kikuyu has been a source of worry to us when we were growing potatoes and maize.

"Having the kikuyu in its young stage, we managed to keep it under control and good crops were taken out. On the head lands, however, it got a very strong hold, and the dustings of the potato manure encouraged it. It formed a solid mat around the head lands and we had an awful job to keep it in check from the time of planting to the next planting of the potatoes, the kikuyu would grow six feet all the way around the paddock, and it got stronger and stronger every year, until it drove us off the potatoes in the end, and so we are faced with a flat of kikuyu, lotus major, with Dutch couch and Yorkshire fog, and so you understand why I do not advocate kikuyu in a first-class swamp.

"Method of Control.—Well, power of course, has come into practice these last few years, and I have been told that a power rotary hoe will rid it with constant tormenting in the heat of summer; but it must be kept on the move, as little pieces soon take root.

"Value as a pasture grass—yes. I maintain it is one of the first grasses to come away. Kikuyu will give the cows a good picking of feed within four to six days after a good shower. Kikuyu grows very quickly. I rank kikuyu as the first feed any farmer should have on his farm, but in the ranking of flush feed for milk, I should be inclined to say sub. clovers, cocksfoot and Rye grasses.

"Weather.—Kikuyu will not stand frost at any time. We have just had an attack of frost a few days ago, and now the flat has gone completely yellow. This will recover again in ten days as soon as the new young shoots come through. That is the only drawback I find with it. Kikuyu will not stand frost on the low flats. On the hills, it is not damaged so much.

"Kikuyu will grow in any sandy ground. We have it all around the hills and only just on coast hills country.

"Carrying Capacity.—Carrying cows on a well established plot of kikuyu is far different from ordinary pasture, as kikuyu always gives a bite. It seems to shoot somewhat more quickly than other pastures. I maintain a cow to 3½ acres is possible all the year around.

"Kikuyu for Hay.—To my fancy, goes very dry very quickly after it is cut. It must be mixed with some other grasses such as sub., lotus major; Yorkshire fog is fruitless to a point, but it helps to bind up kikuyu for cutting of hay."

Sydney Bell, Parryville, Denmark.

"When I first came to this district in 1931 I was very sceptical about kikuyu grass. It was not long, however, before it took complete possession of this beautiful peat swamp, and to-day that land is no longer capable of growing potatoes owing to the density of its growth; but now that this country is a dairy proposition, it has served its purpose very usefully. Clover seed that was sown later, White Dutch, drooping flower, together with lotus major and grasses such as rye and cocksfoot, are thriving and looking well on this country, in spite of the density of the kikuyu grass.

"My one regret to-day is that I did not plant more on my property, because it has excellent feed value. The cows will milk from it, also horses do very well on it; but care should be taken to graze it heavily, and not let it get rank.

"It is susceptible to frosts—the recent frosts we have had in the district has turned it brown, but that does not kill the grass.

"One method of planting is, when ploughing to plant it as you would potatoes, at every third furrow, about three feet apart. By that way you will have an established pasture in a couple of seasons. The other method which is very effective, is to have your land in fallow during the winter months, take a few roots and stamp them in with your foot. This method is suitable if you want to plant large areas and to do it quickly.

"I am planting 10 acres at present by this method—land that I have cleared on paper bark flats. I would strongly recommend it to be planted in small paddocks, where the stock can manure it: like the majority of grasses it thrives on farm yard manure.

"The more you can cultivate this grass the better it grows, but there we have a big problem, especially where it is very thick. The best implement, I think, would be a rotary hoe.

"I feel sure that if more of this grass was planted, especially in the poorer country, it would be a great boon to dairy farmers."

Roots being put into rows by side delivery rake.

T. C. Cooper, Walpole.

"When I took over my holding seven years ago, there was about one-quarter of an acre of kikuyu grass. It was the only decent piece of pasture. This was before I tried copper super.

"I had about two acres of very poor land, the first 18 inches being black sand, and bracken fern about six feet high. Under the black sand there was fourteen feet of white sand overlying clay. I know the depth, because I have put a well down near the spot.

"I cut the bracken, burnt it with a running fire, then planted kikuyu grass every three feet. I fed hay on the pieces, cutting the bracken twice a year. To-day it is as good a pasture as I have got, very little bracken, and a fair sprinking of sub. (Tallarook) clover growing amongst it.

"Since then, I have planted all my poor paddocks the same way.

"Three years ago, I cleared six acres of green stunted jarrah which had been burnt. I used the tractor with the bush and bog at full set. The ti-tree was up to 12 feet high, but having been burnt the year before, it snapped off at ground level. After it had been knocked down, I raked it into rows with the hay rake. After the burn, the bush and bog harrow was used twice. I planted kikuyu grass about four feet apart with a cover crop of Tallarook burr. Now, after three years, it is very good pasture, with very little re-growth.

"I have approximately 30 acres planted with kikuyu. After a while it gets root bound. I have tried burning and find it good. I am sure with suitable subdivision and renovation a man would be able to milk a cow to the acre. I think that kikuyu is very suited for the Walpole and Denmark area.

"I find it does well on sand, stoney and gravel country, but not too good where the clay is very close to the surface.

"I also think that kikuyu grass is as good as two cuts a year of bracken fern, one cut a year with plenty of kikuyu will eradicate the curse."

Bayley Bros., Denmark.

"We have had this grass for about 25 years. It is present in all our paddocks (300 acres). It readily strikes from runners, but we have found the best way is to plant out "turfs" about six inches square placed fairly closely together.

"Winter planting gives good results, the soil being moist and loose, enabling roots to spread quickly.

"Control, so far, has been achieved by heavy stocking, discing with scalloped discs, and infrequently by fires. We do not favour the latter, generally, but we admit that after a fire, a clean, sweet growth is made.

"It grows on a wide variety of types of soil. Even on stony hills, it gives quite a lot of feed.

"Its carrying capacity exceeds anything else we have had since lucerne flea ruined our lucerne.

"The grazing period extends over the whole year, except that on low-lying land, it is often frost-bitten in July-August.

"Its greatest value lies in its ability to 'shoot' after a few points of rain, and it gives the earliest autumn feed. Even during spells of hot, dry weather, kikuyu keeps a cover on the ground, and provides a maintenance ration. Even when well established, kikuyu permits clover, rye-grass to grow freely. For hill country, kikuyu and sub. clover seem to provide an ideal combination. In low-lying land, kikuyu and lotus major thrive together.

"Kikuyu grows in proportion to nitrogen available—superphosphate does not seem to promote growth directly, but by encouraging clovers, nitrogen is introduced. It readily responds to farm yard manure.

"We have carried out limited tests with kikuyu on coast hills with encouraging results, although difficulty in getting clovers to grow there will cause different methods of fertilising. Kikuyu is excellent in preventing erosion on slopes. It definitely checks sweeping fires.

"Against Kikuyu.—When once established, it would appear to be impossible of eradication. It is very hard to mow. It does not make good hay. It spreads steadily, and at no distant future it will be in possession. (If at some time disease of some kind at present unknown should appear, then a 'kikuyu farm' would be in an unenviable position.)

"On the whole, we are decidedly in favour of kikuyu. We carry a beast to less than three acres at all times, and frequently stock more heavily than this. Approximately half our land is partly cleared only, and considerable areas of this land is infested with bracken. We are gradually clearing up logs, etc., and planting more kikuyu which seems to be the only useful growth that offers any opposition to bracken. The carrying capacity will soon be about two acres per head of cattle.

"Kikuyu does not present any difficulty in making silage, at the time when clover is ready for ensiling, the kikuyu is tender and easily cut."

W. Wilde, The Bridge, Hazelvale, via Denmark.

"The grass was first planted about 15 or 16 years ago, that is to say a few pieces of roots were brought on to the farm. The grazable area from those few pieces is about 20 acres today.

"Apart from spreading by runners, stock carry root portions between their hooves. It is also carried further afield when harrowing or logging timber, and there are reports that it is propagated by seed in the droppings.

"On a new piece of land it is very poor, quite unlike other grass or clover which has responded to superphosphate. Kikuyu follows, after you have good pastures which in turn tie down the stock to that spot and so the kikuyu is fed by the droppings which is the start of its ultimate profusion. This time I think would be speeded up by the use of a further manure, say blood and bone.

Roots in a windrow ready for gathering.

"Where it is possible to burn a piece, it makes a wonderful job; within a few days it sprouts again, and from a distance looks like oats. The stock like this new growth very much. It is at its very best in moist ground and it never stays still, but on the higher ground, it looks fairly sick in the height of summer.

"Kikuyu, if well established in any paddock may prevent the cutting of hay. Renovation is best by fire. If possible, a portion should be burnt each year followed by cultivation to spread the droppings.

"With regard to drains, it eventually binds the sides and bottom. The surrounding kikuyu preventing any silt and also stops soil erosion in drains in very wet weather. The difficulty lies in maintaining the proper required depth until the mat of kikuyu in the vicinity of the drain prevents any further silting up.

"I suggest that it is never planted too near the home if at all possible because on good soil your garden is gone for ever.

"The only place where we have planted kikuyu is by the creek and here it is very good indeed, but the total area gets greater each year. My estimation of its value is that it is far superior to Paspalum which in this area has a short season, being dormant in the winter months, growing only in the spring, further it does not establish itself so readily or so well in low lying areas as does kikuyu. Its value in this district is great and certainly well known to most settlers."

J. V. Doley, Byford.

"I have now 150 acres of Kikuyu and expect to plant another 80 acres this year.

"Several methods of collection and planting runners have been tried before the present system has been evolved. We keep one paddock of eight acres for roots because the continual cultivating for roots kills the annuals. A sunpalm cultivator with ⅜in. tynes is run through the grass about three inches deep, and six widths, or three rounds across the paddock 10 chains long, will give enough runners to fill a wagon. This will supply enough good runners to plant three feet each way over three acres.

"The cultivator tears the runners and roots about and pulls out a lot of clods. Next a chain and tripod pasture harrow is run over the clods to break them up and shake the dirt out. Several strokes being needed to make a job of it. A side delivery rake is then used to put it up into windrows after which pitchforks are used to load it into the wagon.

"To plant the cuttings a machine has been made to drop the cuttings into a furrow. Previously a mould board plough was used, but now a machine with a hopper made of two 44 gallon drums, joined end on, to make a trough with an opening at the back end where the operator works, feeding the shaker. A good many clods and cuttings have to be divided by hand. The loosened cuttings are dropped on to a shaker, after the style of a straw walker of a header, which makes the flow of cuttings more even. The cuttings next go down a tin chute which directs them into the furrow made by a 6in. cultivator point. A '\/' shaped scraper is dragged behind the tyne and puts the loose dirt on the cuttings. On the second round the big tractor wheel tyre is run over the last row so that the cuttings and the loose soil are firmed down. Considering the dry summer this year the strike of cuttings has been satisfactory.

"Regarding the value of the grass on my particular property, I cannot speak too highly of its carrying capacity, soil-binding ability against wind and water erosion, resistance to parasites, and ability to withstand endless grazing. I cannot give anything more definite about carrying capacity than to say that on established pastures three breeding ewes with their lambs are run per acre all the year.

"By control I expect you mean the management of the plant and it is on this that the success of establishment and continued usefulness of the plant depends. With the machine now used we put the cuttings into an ordinary pasture paddock and then shut it up. In the spring the crop of pasture hay is cut and the paddock is kept closed during the summer. This first year of nursing is absolutely essential where the soil is inclined to be dry. During the second year judgment must be used in grazing so that the runners are not pulled up or retarded. If this practice is followed the ground should be covered in the third year. I am finding that after the kikuyu is established the clover comes back to its original density.

"The next stage is the control of old and root-bound turf and on this I am still guessing, as I have only just reached this stage of development. From small scale experiments in the garden, I feel sure that if the ground is turned completely over and the top sod severed from its roots, which I know go down at least two feet to the subsoil, a fresh start will have to be made. A good deal of it will die which will give the remaining plants a chance to make a healthy and vigorous growth, which is necessary for it to produce a nutritious and palatable fodder for the animals. If after ploughing, a crop of say, oats, barley or peas were sown on the land a return could be obtained while the grass was becoming established again."

POULTRY FEEDING EXPERIMENTS—No. 4.

By R. H. Morris, Agricultural Adviser.

TWELVE months have elapsed since the poultry feeding experiments discussed in recent issues of this Journal were commenced at Muresk Agricultural College on April 1st, 1947.

Readers are reminded that the tests will continue for a further twelve months. In the meantime, a summary of the first year's findings is presented.

The greater part of the data is in tabular form (see Table), but in order that readers may become more intimate with events relating specifically to individual pens, notes on each pen are included.

Ration I.—Control.

Pen 1 (Australorps)—The birds in this pen averaged 170 eggs per bird for the year and showed the greatest profit of the 12 pens (Table).

Pen 2 (White Leghorns)—The most profitable of the white leghorn pens. The mortality was low for both pens on Ration I.

Ration II.

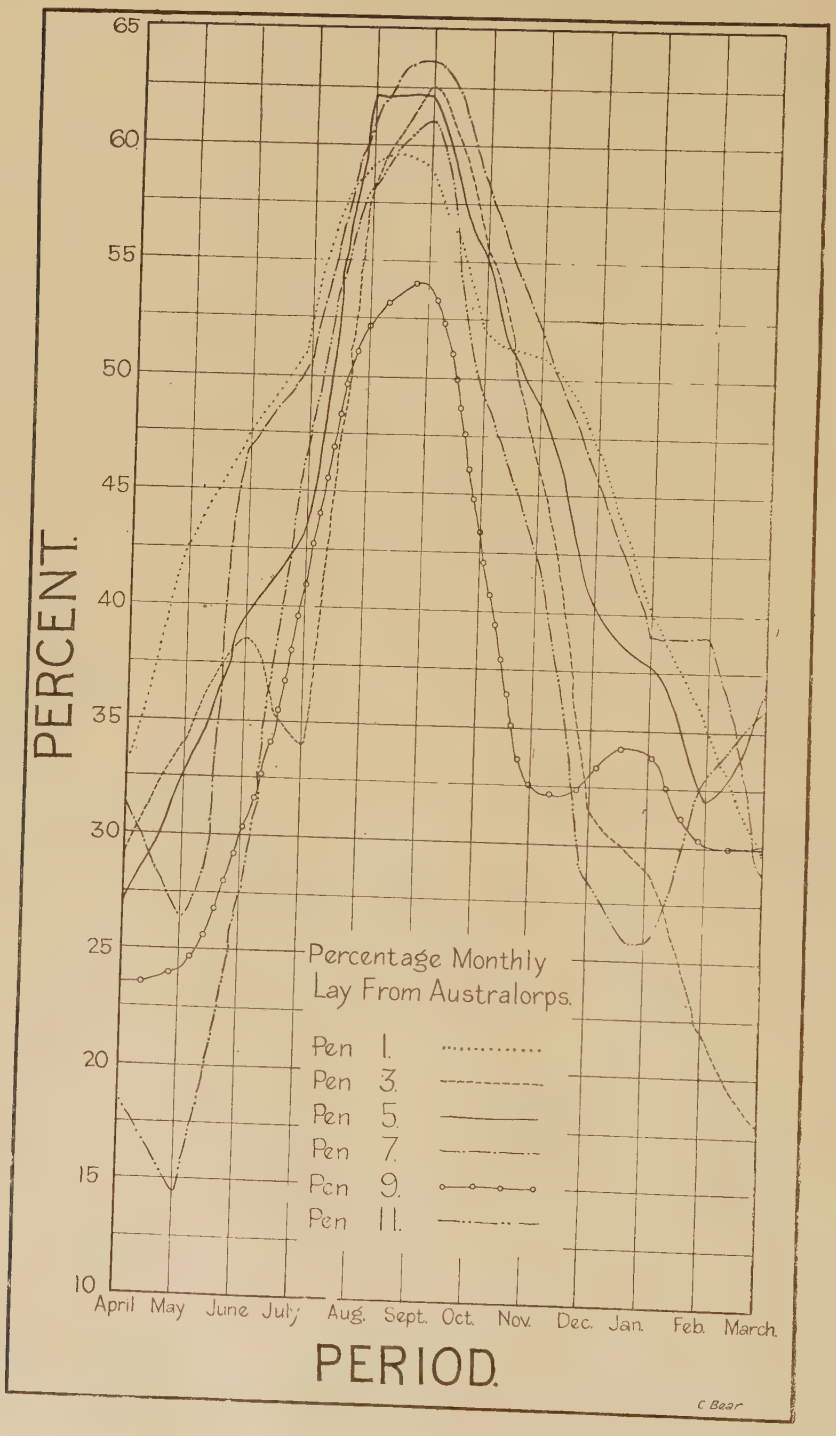
Pen 3.—At first glance the return from this pen does not look encouraging. It is pointed out, however, that the production from this pen dropped rapidly over the last four months of the test, and it is suggested that the high incidence of pullorum in this pen was responsible for this decreased production (see graph I).

At the end of twelve months two pullorum tests at an interval of six weeks indicated that 30 birds throughout the experiment had pullorum. Of these birds, 25 were from Pen 3. The reactors have been removed from the experimental flock. Ninety per cent of the discarded birds from Pen 3 were non-productive at the time of their exclusion from the test and the percentage lay from the remaining birds in this pen improved by 12 per cent. (from 21 per cent. to 33 per cent.) for the week immediately following the exclusion of the reactors. This would seem quite significant when it is realised that the birds were then going into a heavy moult and that the average production from the remaining 11 pens dropped by 4.3 per cent., and by 1.3 per cent. from the other five pens of Australorps for the week concerned. Pen 7 was the only other pen to maintain its production for the week. The production from this pen improved by 0.7 per cent. The profit (value of eggs laid, minus total cost of feed consumed) from pen 3 during the first six months amounted to £17 2s. 9¾d. and for the second six months only £9 14s. 6¼d. The high pullorum incidence was possibly the principal cause of this result.

Pen 4.—This pen showed a profit only slightly below that of the control pen of white leghorns. (Pen 2.)

Ration III.

Pen 5.—In Table it will be seen that the cost of food required to produce one dozen eggs amounted to 9¾d. for Pen 5. This was the cheapest of all the pens. However, Pen 5 did not show the highest profit (Table) as many of the eggs laid by these birds were laid during times of cheaper prices. The results obtained from this pen were particularly pleasing and, should they be repeated in


65
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35
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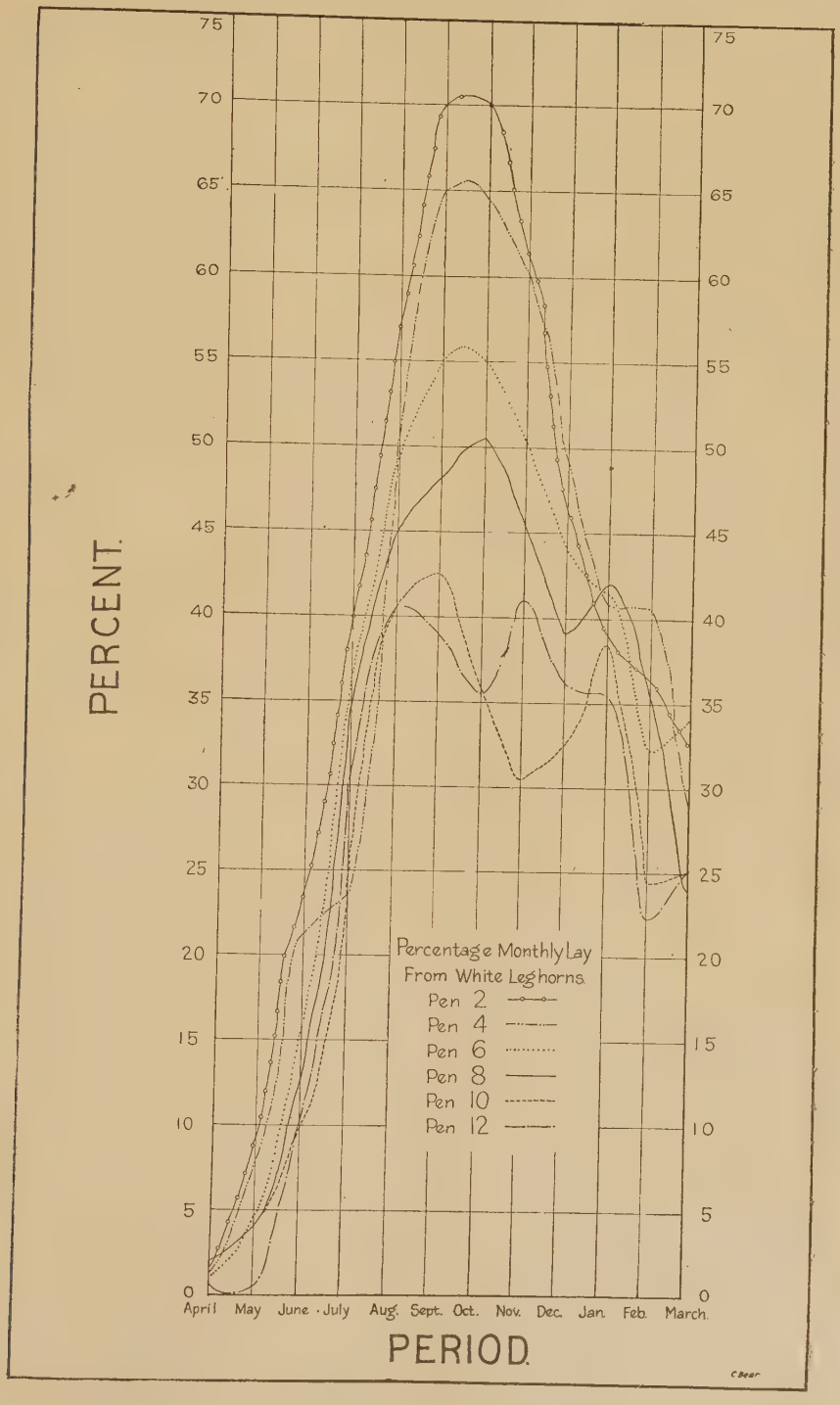
25
20
15
10
PERCENT.
Percentage Monthly
Lay From Australorps.
Pen 1.
Pen 3.
Pen 5.
Pen 7.
Pen 9.
Pen 11.
April May June July Aug. Sept. Oct. Nov. Dec. Jan. Feb. March.
PERIOD.
C Bear

Graph 1.


PERCENT.
75
70
65
60
55
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40
35
30
25
20
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Percentage Monthly Lay
From White Leghorns
Pen 2
Pen 4
Pen 6
Pen 8
Pen 10
Pen 12
April May June July Aug. Sept. Oct. Nov. Dec. Jan. Feb. March.
PERIOD.
C.Beer

Graph 2.

subsequent trials, the practicability of including oats at least at a 20 per cent. level and possibly up to a 40 per cent. level of the total food intake in a laying hen's diet, should be proved. The importance of feeding a suitable type of oat cannot be overstressed. In the current test all the "oat" pens were fed an inferior oat in the first four months of the test during which time the long thin, fibrous, Algerian oat was shown to be unsuitable for feeding to laying hens. For the purpose of feeding to poultry an "inferior" oat is one which contains a low percentage of protein and a relatively high fibre content. Apart from having a low feed value, such an oat is likely to be unpalatable. A variety, such as Guyra, because of its plump grain is most desirable. Crushed Guyra oats are now being fed in these experiments.

The importance of feeding to laying pullets a ration similar to the one on which they were reared is well known by the practical man. In the current tests, birds in groups 2—6 inclusive received a setback in this regard, when they were placed on the experimental ration with consequent retardation of body development and egg production. The birds are now well accustomed to their experimental rations and the second year's returns should give a more reliable guide as to the value of oats as an ingredient in a laying hen's ration.

At this point, it might be opportune to mention that in another experiment, a mash containing 30 per cent. finely gristed Guyra oats has been successfully fed to white leghorn pullets at Muresk since they were hatched last August. They are now nine months old and in addition to the mash referred to above they have received since the eighth week, evening grain, oats and wheat 50-50 by bulk. These pullets are producing as well, and have developed better than the control birds that receive a higher protein ration, composed principally of mill offal and wheat grain. Results from this experiment will be published at a later date.

Pen 6.—Considering the heavy mortality from this pen early in the year, when many of the best birds were lost through cannibalism, the profit shown by the birds from this pen was quite reasonable. Had this vice not been present, the food cost of 10½d. to produce a dozen eggs would probably have been lower.

Ration IV.

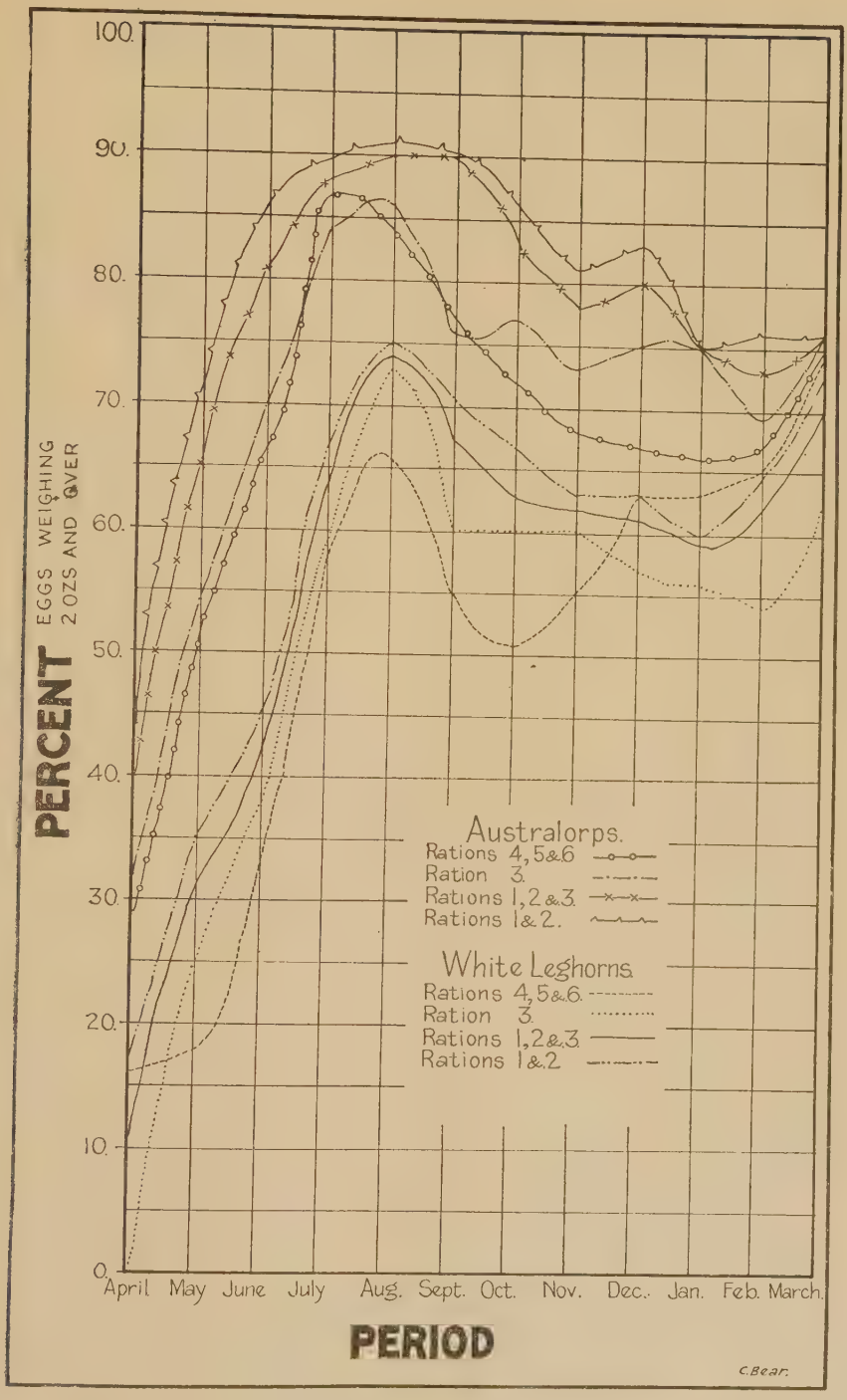
Pen 7.—As the year progressed, it was interesting to follow the increase in egg size of those fowls on Ration IV. For the months of December to March inclusive, the egg size from Pens 7 and 8 compared more than favourably with that obtained from Pens 1-4 inclusive, and was much better than that from Pens 9 and 10.

Although the crushed peas consumed in these experiments cost 16/11d. per bushel, Pen 7 showed a very pleasing financial return at the end of the year. This suggests the importance of carrying out further investigations as to the economics of feeding poultry, not only peas, but other protein-rich leguminous seeds such as the vetch, which could possibly be produced much cheaper than peas, these to be fed in small amounts in conjunction with the now recognised poultry foodstuffs.

Pen 8.—The mortality from this pen was high and the results disappointing.

Ration V.

Pens 9 and 10.—Both pens gave a poor financial return


100.
90.
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PERCENT EGGS WEIGHING 2 OZS AND OVER
April May June July Aug. Sept. Oct. Nov. Dec. Jan. Feb. March.
PERIOD
Australorps.
Rations 4,5&6
Ration 3.
Rations 1,2&3.
Rations 1&2.
White Leghorns.
Rations 4,5&6.
Ration 3.
Rations 1,2&3.
Rations 1&2.
C.Bear.

Graph 3.

Ration VI.

Pens 11 and 12.—The nonpalatability of the algerian oat referred to previously affected these two pens in particular and the results obtained from the birds on this ration were not good.

GENERAL.

Egg Weight.

An article covering the first six monhts of the experiment showed how the relatively high protein rations containing mill offal, favoured the laying of heavier eggs by the young fowls on these rations, when compared with the egg weight of fowls on principally grain diets. It showed, also, that when bran was reduced 20 per cent. by weight as in Ration III there occurred a reduction in egg weight. This tendency continued during the second six months with one exception. From graph 3, it will be seen that:—

1. Rations I. and II. were superior to ration III. for producing heavier eggs with both Australorps and White Leghorns.

2. Rations I., II. and III. were superior to IV., V. and VI. for this purpose with the Australorps and also with the White Leghorns during the first eight months of the test. During the latter four months, however, the White Leghorns on rations IV., V. and VI. produced eggs with a heavier average weight than those produced by the White Leghorns on rations I., II. and III. (See graph 3.)

It will be noticed (refer Table) that the average body weight of the White Leghorns on rations IV., V. and VI. at the end of the 12 months was greater than the average body weight of the White Leghorns on rations I., II. and III. From a comparison of average body weight with egg weight (compare Table and Graph 3) for all pens, a distinct tendency is shown by the heavier birds (pen average) of both breeds to produce heavier eggs. Since the majority of the experimental birds were not reared on the experimental rations, it is difficult to determine the exact influence that the various ingredients of the rations, and more particularly the varying protein content of the rations, have had on body development and egg weight. In view of the inconsistent results during the latter part of the year with the various rations and egg weight, it would appear that the change of rations referred to above influenced egg weight for at least eight months after the change was made. In this regard, and in others, the second year's findings should be of more significance.

Average Weight of the Birds.

From the Table it will be seen that the average weight of the birds in the majority of the pens was lower at the beginning of April, 1948 than it was in September, 1947. In September, 1947, the birds were 12 months old and could therefore be regarded as mature. They were laying heavily and were eating large quantities of food. In April, however, the birds were moulting, less food was being consumed and each pen contained a number of birds that would, on a commercial farm, be culled.

Mortality.

It will be seen from Table that the percentage of deaths was high from those pens on predominantly grain rations and that the percentage from the first five pens (7 per cent.) was reasonable for laying hens under flock conditions.

Prolapse of the oviduct followed by vent picking and cannibalism accounted for five of the deaths from Pen 6. It occurred throughout the year in each of the six pens of White Leghorns accounting in all for 16 birds. Only one Australorp died from this cause.

During the summer, 19 days of over 100°F. were recorded. Fourteen fowls died from heat apoplexy. Ruptured oviducts was another principal cause of death. Thirteen birds died from this complaint.

The three maladies mentioned accounted for half of the total deaths. Chicken-pox was evident throughout the flock during the year, and although it accounted for very few deaths, it is reasonable to assume that the depressing effect on egg production was considerable.

A typical case of a White Leghorn hen suffering from feather picking. The rear portion of the bird only is affected. The condition started at the base of the tail and spread over the back and under the body of the fowl. At the time the photograph was taken the bird had been on a wheat grain-meatmeal diet for eight months.

Feather picking was prevalent in Pens 8 and 10 and to a lesser degree in Pen 12, during November and lasted until the birds moulted in March. At the present time, the birds are refurnishing themselves after the moult and the new feathers are not being eaten. It is interesting to note that Australorps on identical rations to the feather-picking White Leghorns were not affected by this complaint and that feather picking has been previously reported as affecting poultry fed principally wheat diets. In the current trial, several of the affected birds became emaciated and showed leg paralysis with no obvious abnormality of the internal organisms on post mortem examination.

	Ration I.—control	Ration II.	Ration III.	Ration IV.	Ration V.	Ration VI.	Average.	
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	Australorps	White Leghorns
	Bran 30	Bran 30	Bran 10	Wheat 80	Wheat 90	Wheat 60		
	Pollard 10	Pollard 10	Pollard 10	Crushed Peas 10	Meatmeal 10	Crushed Oats 30		
	Wheatmeal 50	Wheat 30	Wheat 50	Meatmeal 10	Ground Limestone 3	Meatmeal 10		
	Meatmeal 10	Crushed Oats 20	Crushed Oats 20	Ground Limestone 3	Bonemeal 3	Ground Limestone 3		
	Ground Limestone 3	Meatmeal 10	Meatmeal 10	Bonemeal 3		Bonemeal 3		
	Bonemeal 2	Ground Limestone 3	Ground Limestone 3					
		Bonemeal 2	Bonemeal 2					
Average cost per 100 lb.—1947–1948—(shillings and pence)....	11 9¼	11 7	12 5	13 4½	13 1	13 2		
Estimated Average crude protein per cent of ration	15 2	15 0	14.3	15.0	13.8	13.5		....
	Pen 1.	Pen 2.	Pen 3.	Pen 4.	Pen 5.	Pen 6.	Pen 7.	Pen 8.	Pen 9.	Pen 10.	Pen 11.	Pen 12.		
Mash and/or grain consumed per bird per day—(ozs.)	5.1	4.4	4.3	3.9	3.4	3.6	4.1	3.4	3.5	3.1	3.9	3.6	4.1	3.7
Mash and/or grain consumed per bird per week—(lbs.)	2.2	1.9	1.9	1.7	1.5	1.6	1.8	1.5	1.6	1.4	1.7	1.6	1.8	1.6
Mash and/or grain consumed per egg laid—(ozs.)	10.9	10.6	12.6	10.5	9.9	10.6	8.9	10.6	10.1	12.0	10.8	13.7	10.5	11.3
Average weight of birds—(lbs.) (a) October, 1947	6.5	4.5	6.3	4.0	6.0	3.9	5.8	3.9	5.6	3.6	5.6	4.0	6.0	4.0
(b) April, 1948	6.1	3.9	5.5	4.0	5.8	4.0	5.8	4.3	5.3	4.1	5.3	4.0	5.6	4.1
Average egg production	170	152	141	138	163	123	166	118	128	92	133	96	....	....
Cost of mash and/or grain required to produce 1 doz. eggs—(pence)	10¼	9¾	11½	10	9¾	10½	10½	1 0½	10½	1 0½	11½	1 2½	....	....
Value of greenfeed consumed at 3d. (per Kerosene tinful of 8 lbs.)	£2 5 9	£2 5 9	£2 5 9	£2 5 9	£2 5 9	£2 1 9	£2 1 9	£2 1 9	£2 1 9	£2 1 9	£2 1 9	£2 1 9	....	.. ..
Cost to feed each bird for 12 months, greenfeed excluded (shillings and pence) . .	12 0½	10 0	11 2¾	9 4¾	10 8	8 10	12 2	10 1¾	9 3½	8 3	10 6	9 6¾	10 11¾	9 4¼
Approximate total food cost per bird per week (pence)....	3	2½	2¾	2¼	2¾	2	3	2½	2¼	2	2¾	2¼	2¾	2½

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SUMMARY OF INFORMATION THAT THE EXPERIMENTS HAVE YIELDED TO DATE.

1. It is impossible to draw definite conclusions from the results obtained to date, but the desirability of feeding laying hens on rations closely approaching the rations they were reared on, in regard to quality, quantity and variety of the ingredients, has been demonstrated. Should the farmer be forced to change his feeding, such changes should be made gradually.

2. The feeding of oat grain as a part of the grain ration also as an ingredient of the mash (preferably in the finely gristed form) would seem economically sound especially today when supplies of other recognised poultry foodstuffs are so short. In view of the results obtained during the early stages of these experiments only a plump, relatively non-fibrous oat can be recommended.

3. On the results obtained from Pen 7, further investigations as to the economics of feeding protein-rich leguminous seeds to poultry in this State would seem warranted.

ACKNOWLEDGMENTS.

Grateful acknowledgment is made to Messrs. K. Cowin and M. Johnson for their ready co-operation in this work.

ANALYSES OF FEEDING STUFFS.

RESULTS of analyses of samples of feeding stuffs taken under the Feeding Stuffs Act, 1928-1946.

(Published under Section 9 of the Act.)

Date Sample taken.	Firm and Brand.	Crude Protein.	Crude Fat.	Crude Fibre.	Sodium Chlor.	Phosphoric Acid P_2O_5.	Lime	Others.
		%	%	%	%	%	%	%
	Anchorage Butchers, Ltd.							
	"Ancho" Meatmeal—						CaO.	
....	Reg. Analysis	†50.56	*15.89	*1 48	0.56	9.39	11.24	..
11-3-48	Sample Analysis	38.75	16.2	1.6	0.61	13.57	17.8	...
13-4-48	Sample Analysis	36.9	18.6	1.3	0.76	12.73	16.02	...
	Angliss, W. & Co. (Aust.), Pty., Ltd.							
....	"Imperial" Fortified Protein Meal—							
....	Reg. Analysis	†50.00	*12.00	*2.00	....	....	....	...
22-10-47	Sample Analysis	53.9	12.2	1.2	....	....	....	....
16-3-48	Sample Analysis	53.6	12.8	1.5	....	....	....	....
	Barrow Linton & Co.							
	"Dukko" Fattening Mash—						*Lime-stone*	
....	Reg. Analysis	†10.0	†4.0	*4.0	1.0	....	3.0	...
24-10-47	Sample Analysis	11.2	6.6	4.1	0.29	....	1.99	....
14-4-48	Sample Analysis	14.0	4.3	3.8	0.28	....	2.18	....
	"Egglayer" Laying Mash No. 2—							
....	Reg. Analysis	†10.00	†3.50	*4.50	1.00	....	....	....
18-9-47	Sample Analysis	13.8	3.3	5.5	0.76	....	....	....
	"Eggoleen"—							
....	Reg. Analysis	†40.0	*12.0	*1.5	....	....	....	....

ANALYSES OF FEEDING STUFFS—*continued.*

Date Sample taken.	Firm and Brand.	Crude Protein.	Crude Fat.	Crude Fibre.	Sodium Chlor.	Phosphoric Acid P_2O_5.	Lime	Others.
		%	%	%	%	%	%	%
8-4-48	Sample Analysis	37.0	8.7	2.7	....	....	....	....
	" Excelsior " Meatmeal—							
....	Reg. Analysis	†40.00	*15.00	*1.50	....	....	....	....
3-9-47	Sample Analysis	39.08	11.48	1.13	....	....	....	....
	" Growell " growing Mash—							
....	Reg. Analysis	†14.0	†4.5	*4.5	1.0	....	3.0	....
14-4-48	Sample Analysis	15.4	4.2	4.2	0.44	....	2.39	....
	" Vitalizer " Chick Starter—							
....	Reg. Analysis	†15.00	†4.00	*4.50	1.00	....	3.00	....
18-9-47	Sample Analysis	14.4	3.2	2.5	0.8	....	4.7	....
	David Gray & Co., Ltd.							
	" Western " Chickbuilder—						$CaCO_3$.	
....	Reg. Analysis	†14.50	†2.50	*4.50	....	....	1.50	....
22-10-47	Sample Analysis	15.6	2.8	4.3	....	....	0·2	....
....	Reg. Analysis	13·5	2·5	4·5	....	....	....	....
18-3-48	Sample Analysis	14.1	4.4	5.2	....	....	....	....
	" Western " Chickstarter—							
....	Reg. Analysis	†16.0	†3.0	*4.5	....	....	1.5	....
9-9-47	Sample Analysis	15.3	4.13	4.45	....	....	1.54	....
....	Reg. Analysis	14·5	3·0	4·5				
17-3-48	Sample Analysis	15.6	3.7	4.5	....	....	....	....
	" Western " Eggfood—							
....	Reg. Analysis	†40.0	†6.0	*4.0	....	....	1.5	....
21-10-47	Sample Analysis	26.2	6.3	1.9	....	....	1.64	....
17-3-48	Sample Analysis	28.6	11.4	3.0	....	....	1.8	....
....	" Western " Laying Mash "A"—							
....	Reg. Analysis	†12.0	†3.0	*7.0	0.5	....	1.5	....
8-3-48	Sample Analysis	14.45	3.4	4.7	0.3	....	0.2	....
	" Western " Lin Meal—							
....	Reg. Analysis	†25.0	†5.0	*7.0	....	....	1.5	....
24-10-47	Sample Analysis	20.4	6.9	5.5	....	....	0.71	....
16-3-48	Sample Analysis	22.5	7.9	5.8	....	....	0.15	....
	Davis Gelatine (Aust.) Pty., Ltd.							
	" Tricalos " Sterilised Bone Flour—						CaO.	
....	Reg. Analysis	†5.0	....	....	....	32.5	40.0	....
27-4-48	Sample Analysis	6.8	....	....	....	30.6	40.6	....
	Kirkby, C. A. & Sons.							
	" KB " Poultry Mash—							
....	Reg. Analysis	†13.0	†3.45	*7.0	0.26	1.21	0.10	....
29-10-47	Sample Analysis	14.6	4.3	6.8	1.08	1.71	0.62	....
	J. Kitchens & Sons Fty., Ltd.							
	" Apollo " Meatmeal—							
....	Reg. Analysis	†40.0	*11.0	*1.5	....	14.0	....	....
29-10-47	Sample Analysis	45.7	11.0	0.5	....	13.7	....	....
	Logie Sons & Duncan.							
	" Champion Bay " Crayfish Meal—							
....	Reg. Analysis	†25.0	*10.0	*6.5	....	....	....	....
5-5-48	Sample Analysis	30.4	0.9	9.8	....	....	....	....
	Milne, W. H. & Co.							
	" Millers " Chickstarter—						CaO.	
....	Reg. Analysis	†15.06	†4.34	*6.1	1.09	1.84	3.11	....
9-9-47	Sample Analysis	15.10	5.14	5.30	0.51	1.72	1.72	....
	" Millers " Laying Mash—							
....	Reg. Analysis	†14.0	†3.04	*5.5	1.5	1.84	2.58	....
12-3-48	Sample Analysis	13.9	4.4	5.2	0.8	1.79	2.57	....
	State Abattoirs.							
	" State Abattoirs, Midland " Meatmeal—							
....	Reg. Analysis	†51.0	14.0	*2.0	....	....	....	....
31-3-48	Sample Analysis	48.1	24.0	3.5	....	....	....	....
	Thomas, W & Co. (W.A.), Ltd.							
	" Thomas " Bonemeal—						CaO.	
....	Reg. Analysis	†10.0	†2.0	*3.5	....	†20.0	....	....
16-4-48	Sample Analysis	14.9	15.1	2.8	....	24.56	....	....
	" Thomas " Calf Milk—							
....	Reg. Analysis	†13.5	†2.5	*6.0	*1.25	....	*10.0	....
8-4-48	Sample Analysis	17.4	5.5	2.7	1.51	....	4.34	....
	" Thomas " Chick Grower—							
	Reg. Analysis	†13.5	†2.5	*6.0	*1.25	....	*3.75	....

ANALYSES OF FEEDING STUFFS—*continued.*

Date Sample taken.	Firm and Brand.	Crude Protein.	Crude Fat.	Crude Fibre.	Sodium Chlor.	Phosphoric Acid P_2O_5.	Lime	Others.
		%	%	%	%	%	%	%
29–10–47	Sample Analysis	14.9	4.2	5.6	1.36	....	3.51	....
8–4–48	Sample Analysis	15.3	4.3	4.5	1.21	....	3.42	....
	" Thomas " Chickstarter—							
....	Reg. Analysis	†14.5	†2.5	*6.0	*1.25	....	*3.75	....
9–4–48	Sample Analysis	17.6	5.0	4.0	1.40	....	3.87	....
	" Thomas " Chickstarter No. 2—							
....	Reg. Analysis	†11.0	†1.5	*6.0	*1.25	....	*3.75	....
10–9–47	Sample Analysis	10.80	2.43	3.98	1.32	....	1.75	....
	" Thomas " Egg Milk—							
....	Reg. Analysis	†15.0	†3.0	*4.0	*3.0	....	*15.0	....
9–4–48	Sample Analysis	20.7	4.6	1.7	3.5	....	7.0	....
	" Thomas " Fattening Mash—							
....	Reg. Analysis	†10.0	†2.0	*6.5	*1.5	....	*3.75	....
22–4–48	Sample Analysis	12.4	2.5	4.2	1.32	....	1.9	....
	" Thomas " Laying Mash No. 1—							
....	Reg. Analysis	†14.0	†2.5	*6.0	*1.5	....	*3.75	....
18–9–47	Sample Analysis	16.1	3.3	4.6	1.4	....	3.34	....
22–10–47	Sample Analysis	15.7	3.6	5.1	1.4	....	3.7	....
12–3–48	Sample Analysis	16.1	3.7	4.5	1.9	....	3.95	....
	" Thomas " Laying Mash No. 2—							
....	Reg. Analysis	†11.0	†2.5	*6.5	*1.5	....	*3.75	....
8–3–48	Sample Analysis	13.9	5.0	4.6	1.8	....	2.34	....
	" Thomas " Quicklay—							
....	Reg. Analysis	†35.0	*10.0	*4.0	*1.5	....	*15.0	....
21–10–47	Sample Analysis	39.9	11.7	1.5	1.3	....	16.2	....
16–3–48	Sample Analysis	32.4	8.1	1.7	2.8	....	16.1	....
	" Thomas " Sweet Cow Food—							
....	Reg. Analysis	†9.0	†1.5	*15.0	*1.5	....	*4.0	....
22–10–47	Sample Analysis	9.8	2.5	11.3	1.7	....	2.0	....
	Tropical Traders, Ltd.							
	" Evelyn " Calf Food—							
....	Reg. Analysis	†10.75	†4.77	*3.86	2.89	....	....	....
13–4–48	Sample Analysis	10.5	1.5	2.2	3.24	....	....	....
	" Evelyn " Horse Food—							Sulphur
....	Reg. Analysis	†12.87	†5.64	†7.14	5.09	1.01	1.54	1.84
1–4–48	Sample Analysis	12.6	6.2	4.2	5.96	0.83	1.49	0.57
	W.A. Meat Export Works, Robbs Jetty.							
	" WAME " Bonemeal—						CaO.	
....	Reg. Analysis	†18.75	....	....	*.25	†26.0	†27.0	....
12–3–48	Sample Analysis	25.2	....	....	.32	24.7	32.2	....
	" WAME " Meatmeal—							
....	Reg. Analysis	†45.0	*13.0	*2.0	....	....	....	....
17–3–48	Sample Analysis	44.5	16.9	1.9	....	....	....	....
	Westralian Farmers Co-op., Ltd.							
	" Red Comb " Chick Pellets " A "—						$CaCO_3$.	
....	Reg. Analysis	†15.0	†4.0	*7.0	....	....	....	....
26–4–48	Sample Analysis	17.0	4.7	4.2	....	....	....	....
	" Red Comb " Laying Pellets, No. 1—							
....	Reg. Analysis	†14.0	†4.0	*7.0	0.5	....	2.5	....
21–10–47	Sample Analysis	12.0	3.1	4.1	0.9	....	3.0	....
26–4–48	Sample Analysis	13.1	3.5	3.4	....	....	2.6	....
	" Wesfarmers " Chick Mash " A "—							
....	Reg. Analysis	†15.0	†4.0	*7.0	....	....	1.0	....
28–4–48	Sample Analysis	16.8	4.7	4.1	....	....	1.2	....
	" Wesfarmers " Chick Mash " B "—							
....	Reg. Analysis	†14.0	†4.0	*7.0	....	....	1.5	....
26–4–48	Sample Analysis	16.3	4.4	4.1	....	....	1.3	....
	"Wesfarmers " Growers Mash—							
....	Reg. Analysis	†13.0	†4.0	*7.5	0.5	....	2.0	....
26–4–48	Sample Analysis	12.3	3.2	4.4	0.8	....	2.3	....
	" Wesfarmers " Calf Food—				less than		less than	
....	Reg. Analysis	†13.0	†3.5	*6.0	1%	....	2%	....
22–3–48	Sample Analysis	15.4	4.9	5.2	0.5	....	1.37	....
	" Wesfarmers " Laying Mash No. 1—							
....	Reg. Analysis	†14.0	†4.0	*7.0	0.5	....	2.5	....
11–3–48	Sample Analysis	13.7	3.4	3.6	1.1	....	1.5	....
	"Wesfarmers " Protein Meal " B "—							
....	Reg. Analysis	†35.0	†7.0	*4.5	....	....	15.0	....
21–10–47	Sample Analysis	33.8	9.7	1.8	....	....	16.1	..

ANALYSES OF FEEDING STUFFS—*continued.*

Date Sample taken.	Firm and Brand.	Crude Protein.	Crude Fat.	Crude Fibre.	Sodium Chlor.	Phosphoric Acid P_2O_5.	Lime	Others.
		%	%	%	%	%	%	%
15–3–48	Sample Analysis	37.8	7.8	2.0	....	....	11.4	....
	" Wesfarmers " Sweetened Dairy Meal—							Copper
....	Reg. Analysis	†11.0	†2.5	*6.0	1.0	....	....	.003
6–11–47	Sample Analysis	10.2	3.8	13.5	1.7	....	....	.014
	Wright, F. W. & Co.							
	" Pannifex " Poultry Pusher—						$CaCO_3$.	
....	Reg. Analysis	†32.0	†7.0	*8.0	Trace	....	Trace	
16–3–48	Sample Analysis	34.6	8.0	8.9	4.6	....	3.1	....
	Taylor, J. L.							
	" Speedy " Meatmeal—						CaO.	
....	Reg. Analysis	†38.0	*14.0	*5.0	0.5	15.0	21.0	....
10–3–48	Sample Analysis	29.1	16.2	1.0	0.3	19.1	24.8	....
7–4–48	Sample Analysis	27.5	16.0	1.2	0.3	19.0	24.2	....
	Young, R. B.							
	" Morlay " Chickstarter—							
....	Reg. Analysis	†15.0	†3.0	*6.0	1.0	2.0	5.0	....
21–4–48	Sample Analysis	17.8	5.9	3.3	0.96	2.8	2.6	....
	" Morlay " Growing Mash—							
....	Reg. Analysis	†13.0	†3.0	*6.0	1.0	2.0	4.0	....
22–10–47	Sample Analysis	12.7	3.1	4.3	0.9	2.2	2.3	....
21–4–48	Sample Analysis	13.8	3.4	3.3	1.08	3.9	5.0	....
	" Morlay " Laying Mash—							
....	Reg. Analysis	†14.0	†3.0	*6.0	1.5	2.0	3.0	....
22–10–47	Sample Analysis	14.1	3.2	4.6	1.3	2.9	4.1	....
10–3–48	Sample Analysis	14.5	4.8	3.6	1.3	3.0	4.5	....

*Maximum. †Minimum.